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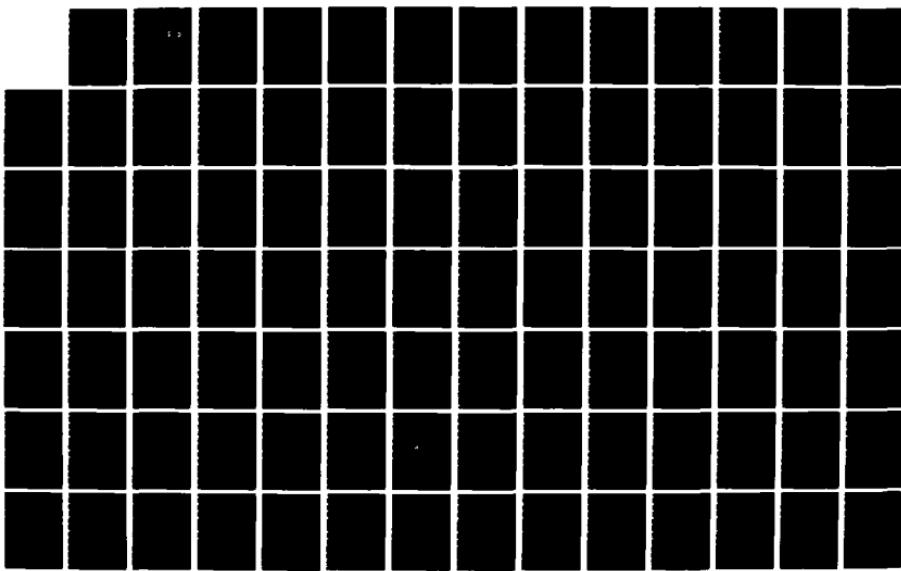
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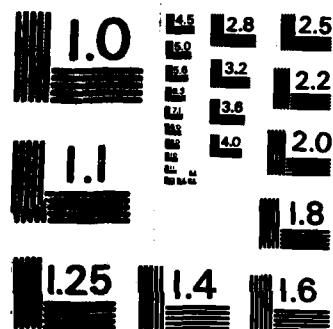
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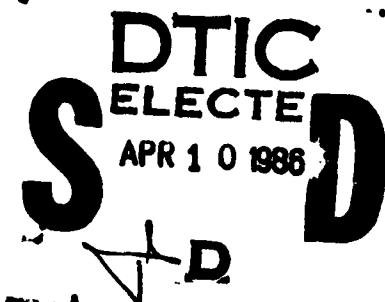
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AIR SUPERIORITY AND AIRFIELD ATTACK

Lessons from History

BDM Corporation
7915 Jones Branch Drive
McLean, VA 22102-3396

15 May 1984



Technical Report

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PREFACE

This is not a history book. It is, however, a selective treatment of historical occurrences. The intent of this monograph is to provide a source of information concerning the specific topic of *campaign planning* for the seizure of operational air superiority, and the role such campaigns have played in past wars.

The selection of specific examples was based upon two general criteria:

- (1) Applicability of available information to the problem of isolating valid historical lessons for modern commanders, and
- (2) Evidence that a concerted airbase attack campaign, in intent and/or effect was carried out.

The historical examples chosen for this monograph meet these criteria. Consideration of the India-Pakistan war convinced us that, while there were a number of airbase attacks, the quality of available information was insufficient to allow a detailed understanding of the combat planning and execution. US air operations in Vietnam provide a wealth of relatively current and detailed information, but it was our judgement that the central intent to carry out a campaign of airbase attacks was absent.

This monograph was a cooperative effort. James P. Peak and Benjamin L. Blustone of The BDM Corporation served as researchers and drafters. Stuart W. Bowen and J. Paul Albritton provided detailed review and insights. Our main thanks, however, must go to General William W. Momyer, USAF (Ret.) who patiently and carefully reviewed numerous drafts. General Momyer's insights into both doctrine and operations were invaluable in shaping the central theme of this monograph.

It is our sincere belief that to be successful, air power must be employed simultaneously in a number of mission areas. The rapid seizure of air superiority may be the "first among equals" in the tasks which are set for air forces in combat. This monograph demonstrates both the value and difficulties of preplanning campaigns and makes the case that the planning of future combat options is an important contributor to success in war.



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TABLE OF CONTENTS

<u>Section</u>		<u>Page</u>
	PREFACE.....	iii
	LIST OF ILLUSTRATIONS.....	vii
	LIST OF TABLES.....	viii
1	INTRODUCTION.....	1
	Scope.....	4
	Lessons from the Battle.....	5
	History and the Modern Planner.....	6
	The Present and Historical Context.....	7
2	OPERATIONS OF THE LUFTWAFFE IN SUPPORT OF THE INVASION OF POLAND, 1 SEPTEMBER 1939;.....	10
	Planning for Air Combat Operations - "Case White" September 1939.....	12
	Lessons from the Battle.....	17
	Observations.....	18
3	OPERATIONS AGAINST GREAT BRITAIN, SUMMER 1940,.....	19
	Strategic Planning for Air Warfare Against Great Britain.....	20
	Operation "Sea Lion" and the Requirements for Air Superiority.....	25
	The Birth of Sea Lion.....	26
	The Combat Environment.....	30
	Lessons from the Battle.....	58
	Observations.....	59
4	OPERATION BODENPLATTE, JANUARY 1, 1945,.....	62
	Planning, Forces, and Targets.....	63
	Attack Execution.....	65
	Lessons from the Battle.....	69
	Observations.....	69
5	THE SOVIET EXPERIENCE;.....	70
	Combat Doctrine.....	72
	The Cataclysm, 22 June 1941.....	75

TABLE OF CONTENTS (Continued).

<u>Section</u>		<u>Page</u>
	An Independent Role for the VVS: The Air Operation.....	77
	The Development of Tactics for Airbase Attack....	79
	Lessons from the Battle.....	84
	Observations.....	85
6	AIRBASE ATTACKS IN SUPPORT OF THE COMBINED BOMBER OFFENSIVE (OPERATION POINTBLANK);,.....	86
	The Planning Background for Pointblank.....	88
	The Combined Offensive - Operation Pointblank....	92
	Selection of Target.....	94
	Airfield Attacks in Support of Pointblank.....	96
	The Effect of Continuous Air Attacks on Luftwaffe Operations.....	97
	Lessons from the Battle.....	100
	Observations.....	100
7	UN FORCES IN KOREA 1950-1953;.....	102
	The Initial Air Situation.....	103
	The Initial Move.....	104
	Lessons from the Battle.....	109
	Observations.....	109
8	AIRFIELD ATTACK IN THE MIDDLE EAST CONFLICTS THE SUEZ WAR (OCTOBER - NOVEMBER 1956);,.....	110
	The Target.....	111
	The Strike Force.....	112
	The Attack.....	113
	Results.....	117
	Lessons from the Battle.....	119
	Observations.....	119
9	THE SIX DAY WAR, JUNE 1967, ^{and}	121
	Egyptian Airfields.....	122
	Egyptian Air Force Strength and Disposition.....	122
	Syrian Airfields and Air Force.....	123
	Jordanian Airfields and Air Force.....	123
	Arab Air Defense.....	123
	Israeli Air Force Strength and Disposition.....	124
	The Air Strikes.....	125
	Lessons from the Battle.....	141
	Observations.....	142

TABLE OF CONTENTS (Concluded).

<u>Section</u>		<u>Page</u>
10	THE YOM KIPPUR WAR, OCTOBER 1973.....	145
	Egyptian Airfields.....	145
	Egyptian Air Force/Air Defense Strength.....	146
	Syrian Airfields.....	147
	Syrian Air Force/Air Defense Strength.....	147
	Israeli Airfields.....	148
	Israeli Air Force/Air Defense Strength.....	148
	Background.....	149
	The Beginning of the War.....	151
	Egyptian Airfield Attacks.....	152
	Israeli Airfield Attacks in Egypt.....	153
	Israeli Airfield Attacks in Syria.....	156
	IAF Weapons and Tactics.....	159
	IAF ECM.....	160
	Sortie Rates and Losses.....	160
	Results of the 1973 War.....	161
	Lessons from the Battle.....	163
	Observations.....	164
	LIST OF REFERENCES.....	165
<u>Appendices</u>		
A	NOTES ON UNIT DESIGNATIONS.....	183
B	GERMAN INTELLIGENCE APPRECIATION OF THE R.A.F. AND COMPARISON WITH CURRENT LUFTWAFFE STRENGTH.....	185
C	R.A.F. FIGHTER COMMAND ORDER OF BATTLE 09.00 HRS., 1ST JULY 1940.....	191
D	THE COMBINED BOMBER OFFENSIVE FROM THE UNITED KINGDOM (POINTBLANK) AS APPROVED BY THE COMBINED chiefs of STAFF, 14th MAY 1943.....	201
E	1956 WAR - AIRFIELD DATA AND AIR-ORDER-OF-BATTLE.....	213
F	1967 WAR - AIRFIELD AND AIR-ORDER-OF-BATTLE DATA.....	221
G	1973 WAR - AIRFIELD DATA.....	233
H	BIBLIOGRAPHY.....	241

LIST OF ILLUSTRATIONS

<u>Figure</u>		<u>Page</u>
1	The radar stations of Great Britain - Summer 1940.....	33
2	Combat environment.....	35
3	Operation BODENPLATTE, January 1945.....	66
4	Strength of the VVS in the Western Military District on 22 June 1941.....	74
5	Comparison of plans.....	95
E-1	Egyptian airfields in the Nile Delta/Canal Zone, October 1956.....	219
E-2	Egyptian airfields in the Sinai and South Egypt, October 1956.....	220
F-1	Northern Egyptian jet-capable airfields, June 1967.....	228
F-2	Southern/Western Egyptian jet-capable airfield, June 1967.....	229
F-3	Syrian jet-capable airfields, June 1967.....	230
F-4	Israeli and Jordanian jet-capable Airfields, June 1967.....	231
G-1	Northern Egyptian jet-capable airfields October 1973.....	237
G-2	Southern and Western Egyptian jet-capable airfields, October 1973.....	238
G-3	Syrian jet-capable airfields, October 1973.....	239
G-4	Israeli jet-capable airfields, October 1972.....	240

LIST OF TABLES

<u>Table</u>		<u>Page</u>
E-1	Egyptian Air Force order of battle, October 1956.....	213
E-2	Status of Egyptian airfields in October - November 1956.....	214
E-3	British and French strike/strike support aircraft basing.....	215
E-4	Aircraft strength by base/carrier.....	218
F-1	Status of Egyptian jet-capable airfields.....	221
F-2	Reported Egyptian Air Force basing, June 1967.....	222
F-3	Status of Syrian jet-capable airfields June 1967.....	223
F-4	Reported Syrian Air Force basing, June 1967.....	224
F-5	Status of Israeli jet-capable airfields, June 1967.....	225
F-6	IAF time-on-target for 5 June airfield attacks.....	226
F-7	Total Arab aircraft losses.....	227
G-1	Status of Egyptian jet-capable airfields in October 1973.....	233
G-2	Status of Syrian jet-capable airfields in October 1973.....	235
G-3	Status of Israeli jet-capable airfields in October 1973.....	236

SECTION 1

INTRODUCTION

The most general lesson to be learned from the comparatively short history of the employment of airpower may be that *airpower is effectively indivisible*; each objective is mutually supporting and interdependent. The air, as the doctrinal pioneers pointed out, is a new field of combat with its own prevailing set of requirements for success. To be truly effective, an air force must meet all of those requirements. It is possible to "tailor" an air force to one specific task--support of ground forces, auxillary to the fleet, or air defense of a nation--but, in virtually every historical case, such a narrowing of perspective has resulted in failure to achieve the maximum potential. R. J. Overy has commented on this aspect regarding the success of the allied use of airpower in WW II:

Both Britain and the United States practiced a general air strategy. A general air strategy involved the pursuit of all four of the major aspects of air doctrine simultaneously, while providing sufficient material resources to meet the demands of such a policy. Thus both powers placed equal emphasis, though not necessarily equal resources, on air defense, strategic bombing, aero-naval co-operation and air support for ground troops.¹

One may extend this reasoning to accept that, in addition to generalized requirements, there are specific tasks which are *non-negotiable* in the employment of airpower. One such non-negotiable task is the seizure of air superiority. The father of modern counter air doctrine, Giulio Douhet, put it simply, "...I have always maintained that the essential purpose of an Air Force is to conquer the command of the air by first wiping out the enemy's air forces."²

In the real world, with its demands for accommodation of combined military strategy and the diffusion of effort based upon the support requirements of other military forces, few air forces have managed to hew to Douhet's single-minded prioritization of tasks. When efforts to seize air superiority have been placed in a lower priority position, however, it has always been because the enemy has been perceived as unable to credibly

threaten military success through the use of airpower. *Air superiority is unimportant only when it is unnecessary.*

A review of modern analytical products concerning offensive counter air operations is somewhat disturbing in this regard. Many studies which have been undertaken to consider the conduct of offensive counter air or airbase attack, have strongly suggested, based upon a host of analytical "measures of effectiveness," that with present munitions, attacks against airbases can no longer be justified. The modern studies concern themselves very effectively with determining the cost of attacking airbases, but few have dealt with the cost of surrendering operational air superiority to the enemy.

Many of these studies can be seen as advocacy positions for weapons systems which do not yet exist; thus, their extremely negative conclusions about the present capabilities for airbase attack are merely a strong reinforcement for the requirement to design a better way to "wipe out the enemy's air forces." The problem is, however, that the amount of skilled rhetoric directed toward the denigration of the present form of the airbase attack mission may be wreaking an unjustified and unnoticed change of doctrine.

The purpose of this paper is to reconsider the lessons of history regarding counter air operations in general and airbase attack campaigns in particular. Why does the combat doctrine of so many air forces reflect a single-minded preoccupation with counter air warfare? What can history teach us about the specific approaches to air superiority which have worked (or failed) in the past? More important, what can history tell us about the effects of losing "command of the air?"

It is important to recognize that the central theme of this monograph is air superiority; this topic is discussed through the mechanism of analyzing airbase attack campaigns. The intent is to provide insights from history which may be useful for modern readers. It is certain, based on research presented here, that the Soviets for their own reasons have decided to reemphasize the topic of counter air warfare in general and airbase attack planning in particular. This alone would suggest that

planners in the West dare not ignore this set of targets which have proven so important in history.

Finally, it should be reiterated that the key goal of air superiority operations is the *destruction and disruption of enemy air forces*, not necessarily enemy air bases. In the classified research which accompanied the compilation of this monograph, no target or approach which could disrupt the operations of enemy air forces was disregarded. It is clear, for instance, that the "indirect approach" to seizure of air superiority was an important theme of the planning for the Combined Bomber Offensive in World War II. This planning approach which concentrated as much upon "strategic" targets in the economic infrastructure as upon direct attacks upon the force structure of the German Luftwaffe, succeeded brilliantly in smashing the air power of the Third Reich. Equally, however, the "indirect approach" failed the Luftwaffe in the anti-radar campaign which it briefly essayed during the Battle of Britain. These cases are reviewed here as important historical evidence in the search for effective approaches for air superiority.

This monograph does not advocate the attack of airbases by manned aircraft over any other means of attack, but both it and the accompanying classified research monograph do concentrate on weapons and weapons systems which presently exist in the inventories of the US and our allies in NATO.

When the problem of attempting to rapidly seize air superiority in a future war is considered from such a constrained and realistic perspective, the situation facing the Commander of Allied Air Forces Central Europe essentially boils down to one analogous to a remark attributed to bank robber Willy Sutton:

"Why do you rob banks, Mr. Sutton?" went the question.

"Because that's where the money is," said Willy.

Modern planners might choose to avoid the difficult and operationally costly task of airbase attack--but seizing air superiority appears to be a non-negotiable requirement of modern combat. Air superiority means control of the air. One high leverage approach to control of the air is destruction of enemy aircraft; airbases are where the aircraft are.

The case is made strongly in this presentation that between doctrine and successful execution there must be a *plan*. Historical research has been undertaken to provide a focused look at airbase attack campaigns of the past. Its intent is to consider the *planning of campaigns in the air*. Vast changes have occurred since the end of World War II, but there is also much which has not changed and cannot change. These unchanging conditions and requirements make the history of airpower a useful and even critical area of study for the modern planner. This monograph demonstrates the underlying factors which make the requirement for air superiority a critical part of doctrine; the accompanying classified monograph addresses the problems and opportunities of planning development for the critical requirement of air superiority.

SCOPE

The examples were chosen primarily for their apparent utility as sources for meaningful historical lessons, and secondarily on the basis that detailed and convincing information was available to allow a useful understanding. Where they were available, a concerted effort was made to use primary sources. The examples chosen were:

- The German Experience
 - Luftwaffe Support in the Invasion of Poland, 1939
 - The Luftwaffe in the Battle of Britain, 1940
 - Operation *BODENPLATTE*, 1945
- The Soviet Experience
- The Combined Bomber Offensive 1944-45
- UN Forces in Korea 1950-1953
- The Mid-East Wars 1956, 1967, 1973

The insights into Luftwaffe planning drew heavily upon material made available through the USAF History Project. Many of the monographs written by former senior German commanders during the life of that uniquely valuable program were never published, but they were made available in manuscript form for the preparation of this monograph.

British information was drawn primarily from a number of excellent professional histories including *Battle Over Britain* by Francis K. Mason, and from declassified British Ministry of Defense documents.

Details of the Combined Bomber Offensive and its effects were provided by a number of popular and professional sources, notably supported by Haywood S. Hansell's *The Air Plan That Defeated Hitler*. Karl Gundelach's study entitled, "The Effect of the Allied Air Attacks on the Ground Echelon of the Luftwaffe in Western Europe in 1944," was useful in portraying airbase attack from the German perspective, and the republished issues of *Impact*, a formerly classified pictorial journal of the air war, provided a great deal of contemporary "color."

Observations on the air superiority campaign in the Korean Conflict, 1950-53, were directly supported by Robert F. Futrell's excellent three-volume official history as well as by numerous declassified documents which represent the Weekly Intelligence Summary of the Headquarters, Far East Air Force.

Analysis of the Mid-East wars was aided by recently declassified material including a January 1968 after-action interview with General Hod, Israeli Air Force commander. This information was vital in separating fact from a great deal of fiction that has been written about the June 1967 conflict. Similarly, detailed information on sortie rates and attrition figures in the 1973 war was taken from "The Development of Soviet Air Defense Doctrine and Practice," (a Sandia National Laboratories - sponsored analysis). This document provided clarity to a mass of conflicting claims and related facts.

LESSONS FROM THE BATTLE

Throughout this monograph, where it is deemed appropriate, there are short sections of observations about particular campaigns. Military historians are generally concerned about the problem of "Monday morning quarterbacking." The use of detailed non-contemporary evidence to critique a tactical commander's decision-making is a practice to be carefully

avoided by good military historians. These sections, entitled "Lessons from the Battle," are explicitly posed as the views of a Monday morning quarterback. The purpose of these sections is to discuss the lessons which may be of value to modern planners. This approach was chosen early in the preparation of this paper; thus, the editorial comment in the main text has been purposely limited while it is given free rein in the "Lessons." The bulk of this presentation is intended to be objective; however, the "Lessons" explicitly reflect our biases and modern concerns.

HISTORY AND THE MODERN PLANNER

George Santayana's lament that those who do not learn the lessons of history are doomed to repeat them is a cliché of little value to either the military historian or to the modern military planner or commander who seeks the lessons. Nothing ever repeats with sufficient fidelity to allow the set-piece application of a historical solution. Battles which resemble Cannae may be fought again, but they will not use the weapons of Cannae, or be fought at the same pace, or even necessarily have the same outcome. For the modern historian and for the modern reader, Sir Julian Corbett's admonition is apropos, "The value of history in the art of war is not only to elucidate the resemblance of past and present, but also their essential differences."³

This monograph and the classified companion, which presents specific options for airbase attack, were written at the request of the Assistant Chief of Staff, Operations, Supreme Headquarters Allied Powers Europe (SHAPE), and the Commander, Allied Air Forces Central Europe (COMAAFCE) and were sponsored by the Defense Nuclear Agency. The general focus of interest is thus on lessons which could support the development of overall air strategies in the context of combined operations by the members of NATO. The specific focus is on the unique and difficult problems of contingency planning for combat air operations in the context of a Central European conflict between the Warsaw Pact and NATO, and on the role and specific nature of offensive counter air operations in such a conflict.

We have sought during this program to avoid the problems of initial postwar planning that were highlighted by General Perry McCoy Smith in an earlier work:

The content of these postwar plans highlights a number of fundamental errors made by the military planners, and these errors in turn point up some of the real difficulties that face planners in large bureaucracies. The planners neither incorporated the lessons of World War II into their plans nor even attempted to determine what these lessons might be.⁴

A concerted effort has been made here to seek lessons and to use them as the keystone for option development. The specific options suggested are, of course, classified. It is possible, however, to provide a general discussion here of both the "resemblances" and the "essential differences."

THE PRESENT AND HISTORICAL CONTEXT

It is always tempting to begin to force-fit the present European situation into the mold of World War II air strategy. While the former major opponent has since become a staunch ally, and one former ally the principal potential enemy, the airfields now in service are many of the same that were in service then. A modern fighter-bomber can far outstrip the B-24 "heavy bomber" in deliverable payload and can nearly match the B-17 in bomb carrying capacity, if not in range. The air defenses in the eastern half of Germany may now be individually more deadly but are certainly no more dense than air defenses were then.

There is one overriding factor of change, however, which affects every judgment. The advent of the nuclear weapon and the ballistic missile brought about changes which have forever redefined the meanings and boundaries of the terms "strategic" and "tactical." The Combined Bomber Offensive (Operation POINTBLANK) was strategic air war in its essence. The intermediate and overriding objective of POINTBLANK was destruction of the German fighter force. This objective was seen as a means to enable the prosecution of the final goal which was total economic dislocation of the

German nation's warfighting capacity. It is beyond the scope of this section to delve deeply into the planning and execution of Operation POINTBLANK; it suffices to say that in modern conditions a theater air commander is almost totally separated from decisions which would envision the scope of commitment and destruction encompassed in POINTBLANK.

The *intermediate* air superiority task of POINTBLANK, suppression and destruction of forces-in-being, has become the *primary* combat task of a modern theater commander. Direct attack against the aviation industry supporting the air forces of the Warsaw Pact has become inescapably bound to the strategic realm, and, by extension, to the employment of nuclear weapons.

The key planning task of the present COMAAFCE in the area of air superiority has become the design of options which could support the *rapid* seizure of operational air superiority in the battle area and its environs. Operational air superiority in this modern context means the preservation of NATO's air assets and the preservation of the *freedom* to operate whenever and wherever NATO airpower is required. At the same time, COMAAFCE must be able to hamper the combat operations of Warsaw Pact air units to the point that they are unable to fulfill their basic combat roles with sufficient impact to substantially affect the Central Battle.

The planners of POINTBLANK saw suppression and destruction of forces-in-being as only a means to assure freedom to operate and carry out a strategic air war. The modern planner's horizon, in terms of target selection in support of air superiority, has been narrowed, and the pressure to achieve operational air superiority rapidly has been severely intensified. The critical determinants of success will be assurance of NATO's freedom to provide air support to engaged forces in a spectrum which ranges from Close Air Support (CAS) to deep interdiction, and assurance that the enemy can never mount successful air attacks of such intensity that NATO ground operations are totally disrupted or precluded.

Over the long term, it is clear that the further development of airfield attack weapons, and even the development of entire weapons systems optimized for airfield attack, may be required. Whether such weapons and

weapons systems are developed in the future or not, history indicates clearly that no development could be more important than the development of an overall planning framework for air superiority.

The doctrine which would support operations for the seizure of air superiority already exists in varying degrees in the NATO air forces. What is missing is a planning framework which can allow the development, modification, and conceptual testing of attack options under peacetime conditions. The plan which spawned the US portion of Operation POINTBLANK was completed in July 1941, before the US had entered the war. This plan was modified and expanded by tactical decisions, but it still formed a central framework for force planning and target selection. It is always the province of the commander to decide the final form of combat options; the existence of a central planning framework, however, allows him to continually review and enhance his combat options.

The time to create the framework and begin to develop options is now.

SECTION 2
OPERATIONS OF THE LUFTWAFFE IN
SUPPORT OF THE INVASION OF POLAND,
I SEPTEMBER 1939

The air operations in support of the invasion of Poland have become a metaphor for the intense and rapid seizure of air superiority through attacks against the airbase structure. Modern historical research,¹ however, suggests that the elimination of the Polish Air Force as an effective fighting force came not through an airbase attack campaign but through the failure of the Polish logistics system to support dispersed operations from austere and covertly occupied airbases.

As practiced observers of the developing Luftwaffe, and particularly of the operations of the *Legion Kondor* in Spain, the Polish defense planners had little faith in their capabilities to sustain operations from known airfield locations in the face of a German onslaught.

As early as 1937, in accordance with "Plan Z,"² the Polish high command had decided to create a network of secret dispersal airbases which would be occupied only in an emergency situation. The plan envisaged the construction of 80 to 100 airfields throughout Poland. Along with the air force modernization program which had commenced in 1936, the target date for completion was April 1942.

By August 1939, on the eve of the German invasion, some forty-three airfields had been selected for emergency deployment. Increased readiness was declared on 24 August and secret deployment commenced with the movement of ground support staffs plus supplies of fuel, armament, and food for periods of four to ten days. Supplies for a further six days were to be stockpiled at distribution points for subsequent movement to deployed units. Most of the movement of the ground echelon had been completed by 26 August with actual deployment of combat aircraft beginning on 27 August.³

The postponement of the German attack from 26 August until 1 September saw much of the combat strength of the Polish air force vacated from its

main operating bases before the major attack developed. In the words of a veteran of the invasion, Major F. Kalinowski:

The German Luftwaffe did exactly what we expected. It attacked our airfields and tried to wipe out our aircraft on the ground. In retrospect it seems quite naive of the Germans to have believed that during the preceding days of high political tension, and with their own obviously aggressive intentions, we would leave our units sitting at their peacetime bases. The fact of the matter is that by August 31st, not a single serviceable plane remained on them. In the previous forty-eight hours all of us had been transferred to emergency airstrips. As a result, the Germans' opening air blast completely failed in its purpose....⁴

What is not captured in this observation is something which was clearly seen by the Germans--the Polish Air Force had neither the strength in the ground echelon nor the communications infrastructure to support dispersed operations. "All in all the Polish ground service organization appeared cumbersome and unmaneuverable because it was hampered by the organization of the air forces in groups and by the fact that it had to rely on poor traffic and signal communications facilities."⁵ Thus read a post war evaluation of the Polish operation compiled by high ranking German officers in support of the USAF history project. From this same source, however, it is clear that Luftwaffe planners failed to realize that the bulk of the Polish Air Force had escaped the initial day's attack. Yet, it made little difference because the Polish Air Force quickly succumbed to the failure of its own supply system. The Germans had been right--but not for the reasons they assumed.

The initial knockout blow had failed to destroy the Polish Air Force. But the Polish expectation of the attack, their failure to create a new infrastructure to support the dispersed basing concept, and, finally, the intense pressure put on Polish ground forces by the fast moving German columns totally disrupted any possibility of mounting sustained effective combat operations. Within a week, the supply situation was hopeless.⁶ Polish fighter units, grounded in unfamiliar areas and completely isolated from communications (which in the Polish operational scheme were to be

provided by the ground divisions to which the tactical squadrons were attached)⁷ were forced to mount reconnaissance sorties to attempt to locate fuel resupply convoys along the refugee-choked roads. The Polish Air Force ceased to exist by 18 September.

The Luftwaffe indisputably won its first air campaign of World War II. The Polish Air Force was not, however, destroyed, and the Luftwaffe was to meet its veterans again over France and Great Britain as volunteers in the Armee de l'Air and the RAF. More important, for the future campaigns, was the fact that a trend toward compromise of basic tactical doctrine had been established and the success in Poland would be used again in the future to justify further separation from the basic tenets of Luftwaffe doctrine.

PLANNING FOR AIR COMBAT OPERATIONS - "CASE WHITE" SEPTEMBER 1939

The initial planning for Luftwaffe operations in support of the invasion of Poland contained a textbook counter air operation. Both in terms of existent Luftwaffe tactical doctrine and in modern understandings of the principles of air warfare, the plan was a pure portrayal of an attempt to rapidly smash an opposing air force by exploitation of mass, concentration, and surprise. As modern research has suggested, this operation had relatively little to do with the actual demise of the Polish Air Force. What makes it a worthwhile topic for study is the insight which it can provide into the basic nature of Luftwaffe counter air doctrine and the foreshadowing of difficulties which were to become more serious as the commander-in-chief of the Luftwaffe diverted farther and farther from the basic provisions of the existing tactical doctrine.

Air planning for CASE WHITE, the invasion of Poland, was actually not a long drawn-out affair. The intelligence preparation had been completed in a period of only four months.⁸ The products of this intelligence preparation were disseminated to each *Geschwader* involved in the operation:

- (1) 100 copies of aircraft identification tables,
- (2) 12 copies of "Intelligence pamphlet on Poland",
- (3) 12 copies of military-geographical description of Poland, and

(4) 12 copies of Airfield Atlas on Poland.⁹

In addition, the results of photographic reconnaissance sorties flown throughout the summer provided air photo reprints, target interpretations, and air photo panoramas covering larger target areas and frontier fortifications. These photographic products covered:

- (1) All Polish airfields save three,
- (2) All supply depots of the Polish ground service organization,
- (3) All major cities (photo panorama), and
- (4) The Hela peninsula and the port of Gdynia.

One hundred copies of this material were available for each unit earmarked for the operation, plus the same data for each unit in the West which might be committed later.

The initial plan, developed after a General Staff map exercise in April, envisioned the commitment of fully two-thirds of the operational strength of the entire Luftwaffe for the initial strike against the Polish airbases. Final decisions were reached at a Führer Conference at Obersalzberg on 23 August.¹⁰ Dispersal was ordered to begin on 25 August, with final readiness to be achieved for an attack on 26 August. Hitler Directive Number 1, issued at the conclusion of the Obersalzberg meeting, was doctrinally pure. "The first attack by the bulk of all forces will be directed at the Polish Air Forces; after this the main emphasis in operations will be on support for the Army." The attack order was cancelled at 1940 hours on 25 August and by the time the order was reinstated for the attack on the morning of 1 September much of the force allocation had begun to erode.¹¹

Luftwaffe counter air doctrine as it existed in 1939, and as it was expressed in Luftwaffe Manual Number 16, was a faithful reflection of the teachings of Douhet combined with the basic assumptions of Clausewitz.¹² Douhet's observations have often been characterized as primarily advocating terror bombing of civilian populations. In fact, Douhet's main thrust was toward the immediate seizure of air superiority by smashing the enemy air force on the ground,¹³ and it was this relatively simple declaration that dominated Luftwaffe counter air doctrine.

The second concern of Luftwaffe planners was cooperative support of the Army; and, in the intervening period between the first postponement and the final execution of the attack, the random reapportionment of sorties set in with a vengeance. The final plan changed significantly. The driving factors in the redistribution of effort were (1) the intervention of *Oberkommando der Wehrmacht* (OKW), (2) the unquestioned and unconstrained authority of the Commander-in-Chief of the Luftwaffe to invoke uncoordinated changes at the tactical level, and, (3) the comparatively free hand of the *Luftflotte* commanders to arrange local-level redirections.

General *Der Flieger* Wilhelm Speidel points this out clearly:

"The information available on the Polish situation provided conditions for the initial concentrated attack by the operational Luftwaffe to destroy the ... air forces and their ground service installations, and no basic changes were necessary to the prepared plans of operations. In contrast, the last detail (sic) operational orders issued by the two air fleets reveal clearly that the primary concept of the Commander-in-Chief of the Luftwaffe for the conduct of operations, namely, the necessity to annihilate the hostile air forces in their bases, had been modified considerably in the meanwhile by orders from the Supreme Command favoring the Army and the Navy."¹⁴

The changes which took place over the intervening four days levied a substantial operational impact. The first of these was "OPERATION DIRSHAU" which envisioned a precision dive bomber attack, not to destroy a bridge--a mission the Stukas might have accomplished--but to prevent the Poles from destroying the Dirshau bridge over the Vistula River. The preparation for this operation consumed the sorties available from I/STG1 and III/KG3. These sorties then correspondingly reduced the total of those planned for the coordinated airfield attack scheduled to occur at 0600 hours. The dive bombers cratered the bridge approaches and were followed by a high altitude attack by the Do17's of III/KG3 which succeeded in setting numerous fires in the village of Dirshau. The attacks, however, failed in their purpose; within two hours the Poles sent the Dirshau bridge crashing into the Vistula, long before the German ground forces could arrive.¹⁵

In an *ad hoc* arrangement by General Kesselring, the Commander of *Luftflotte 1*, *Kampfgeschwader 1* was reinforced with two *Stuka Gruppen* and parcelled out to support the Navy.¹⁶ This diversion resulted in the loss of fully fifty percent of the effort of the First Air Division to the planned airbase attack. The "Special Purposes Air Command" under Lieutenant-General Wolfram Freiherr Von Richofen, consisting of four *Stukageschwadern*, one ground attack unit (*Hs123* "battle planes"), and one long-range fighter group, was similarly dedicated to the ground forces. In addition, directives sent by Luftwaffe headquarters on 31 August designated areas of main effort for immediate Army support operations. These directives had not been considered in the original plan. Finally, Göring's plan for the concentrated attack on Warsaw (OPERATION *WASSER KANTE*) was scheduled for the afternoon of the first day. For air units still at their peacetime bases in the Reich, this standing order meant that no sorties could be flown at all until *WASSER KANTE* was initiated since aircraft could not return to their bases, be turned, and still meet the timing requirements imposed by the Commander-in-Chief of the Luftwaffe.

This wholesale erosion of the originally planned airfield attack had finally resulted in less than half of the planned force being available for the opening blow. Bekker holds that with two-thirds of the entire Luftwaffe arrayed against Poland, fewer than 400 "bomb carriers" were finally committed for airbase attack.¹⁷ The pure knockout blow thus had begun to atrophy severely before it could even be launched. Then nature took a hand.

Dawn on 1 September 1939 brought truly terrible weather across Eastern Europe. Ground fog shrouded many of the bases in eastern Germany while the visibility and ceiling at Warsaw was one-half mile and 600 feet. At 0445 hours, the Stukas enroute to the Dirschau bridge went in at thirty feet. By 0550 hours, *WASSER KANTE* was cancelled for the day. In all, of the fourteen and one-third *Gruppen* only five could make their scheduled take-offs.¹⁸ Only five airfields could be taken under attack, and only the airfield at Warsaw Okecie was reported to hold a sizable concentration of

airframes. Operational reconnaissance aircraft reported fifteen airfields deserted.¹⁹

As the fog began to burn off near noon the pre-planned attack began to unfold. Almost 500 miles from Warsaw, at Delmenhorst, Wunstorf, and Hanover Langenhagen, the aircraft of KG27, now freed from the standdown for *WASSER KANTE*, awaited take-off orders for an attack against Warsaw area airfields. At 1325 hours, the three *Gruppen* lifted off enroute to their targets. Arriving in the target area about 1730 hours, KG27 and its escort were intercepted by thirty Polish fighters--virtually the only reaction. By 1800 hours, the fog once again descended and operations were finished. As Speidel expresses it, "...the German attack had not achieved the desired measure of surprise...because the planned large-scale German attack had deteriorated into a series of individual attacks isolated in timing and area."

The daily report from the north read, "*Luftflotte 1* enjoys superiority throughout its combat zone...to a large extent the enemy air force remained unseen."²⁰ The Luftwaffe high command orders for 2 September responded sharply:

Luftflossen 1 and 4 will on 2.9 continue to pursue hostilities against the enemy air force.... Special watch will be resumed on air bases contiguous to Warsaw, Deblin, and Posen.... The Commander-in-Chief orders that the whereabouts of Polish bombers shall be located, and for this purpose adequate reconnaissance patrols shall be flown from first light onwards.... Pending location of the enemy bomber force, our own bomber units will remain on ground in readiness for immediate attack.

The "disappearance" of the enemy air force clearly startled Luftwaffe planners. From wholesale diffusion of effort on the first day, Goring suddenly was willing to stand down and withhold sorties for what had once again now become a critical mission.

Again on the second day, Polish air activity was scarce although one source attributes this to an inability to intercept the scattered German formations.²¹ KG4, the "General Wever" *Geschwader*, attacked the airfields at Krakow, Katowice, Kielce, Radom and Lublin in full *Geschwader* strength

with escort. Ten to twelve aircraft were reported destroyed at Lublin and a further fifty aircraft on the airfield at Deblin. It is not clear now whether these were actually operational aircraft or written-off machines. But it did not matter.

The OKW report for 2 September said, "All aircraft existing in hangars or in the open were set on fire. From this it can be assumed that the Polish Air Force has received a mortal blow. The German Luftwaffe has won undisputed mastery over the whole of Poland." In contrast, perhaps as many as 150 Polish bombers of all types were still operational on this day. Until 18 September, the Polish air force continued to fly against the German forces carrying out 229 sorties and delivering 340,000 pounds of bombs.²²

LESSONS FROM THE BATTLE

The first airfield attack campaign of the German Luftwaffe violated doctrinal precepts and failed to accomplish its stated objective; this failure, however, was masked by the confluence of other factors. The target intelligence was comprehensive, but its interpretation was faulty. This failure to measure the effectiveness of attacks and to effectively select counter air targets was overshadowed by the offensive mass of the Wehrmacht and the fast movement of armor.

Luftwaffe planners had assumed initial success. Nothing in surviving documentation suggests that any consideration had been given to contingencies such as bad weather, nor was there any organized attempt to track the deleterious effect of wholesale and uncoordinated reallocation of sorties on the overall strategic campaign plan.

What Göring, and probably Adolph Hitler took from this experience was that air superiority was even easier to achieve than previously calculated, and that Luftwaffe tactical doctrine might be overly restrictive. When the Luftwaffe operated alone against the British Isles within one year the violation of doctrine would exact a higher price.

OBSERVATIONS

- Tactical planning appears to have been relatively thorough and took cognizance of the serious requirement to establish immediate air superiority.
- The plans, though reasonably detailed, were extremely "brittle." No alternative options were created for bad weather, bad intelligence, or bad luck.
- Once the plan was implemented, the operational momentum was high and the main trend was to press on as if all conditions were in accordance with the plan.
- The failure of tactical reconnaissance flights to find Polish aircraft on the major airfields should have been recognized immediately as a danger signal.
- Göring's plan for Operation WASSER KANTE was a needless diversion of valuable assets. The timing was wrong; the intent was questionable. No respected theoretician believed that a single attack, even against a major city, could shatter national resolve.
- Between the initial planned execution date for the attack on Poland and its actual date of execution the "air plan" effectively ceased to exist. Too many influential persons could sub-allocate the overall effort, and there was no system for reviewing the effect that the undisciplined "horse trading" created vis-a-vis the overall intent of securing air superiority.
- The "success" in Poland was disastrous for the Luftwaffe over the long run. It cast the best doctrinal thinkers in the role of over-conservative detractors and appeared to support Göring's bombastic claims about the power of the Luftwaffe.
- The Luftwaffe, despite its carefully nurtured image, was too small and too poorly equipped for the tasks assigned to it. The string of successes in Poland, Scandinavia, the Low Countries, and France masked the need for further development.

SECTION 3
**OPERATIONS AGAINST
GREAT BRITAIN, SUMMER 1940**

The scope of this monograph encompasses part of that period known as "The Battle of Britain". A great deal of effort has been expended by historians in attempting to quantify and specify the exact nature of this "battle". The starting point, the turning points, and the span of the conflict have been defined and redefined as various observers sought to portray the situation from yet another viewpoint.

The Battle of Britain has been portrayed most often as the story of RAF Fighter Command in defense of the British Isles, but the battle's history equally contains the story of German planning for strategic air warfare. The rapid development of air superiority over at least south-eastern England was a *sine qua non* for all other German intentions in the summer and early autumn of 1940. History proves that the attempt to secure air superiority failed, but it is important that modern audiences understand why. Is it true, as one observer stated during the battle, that a well-dispersed air force simply cannot be destroyed on the ground?¹ Alternatively, did the German prosecution of air operations against Great Britain represent a further breakdown of the Luftwaffe's own military doctrine?² Both of these possibilities find expression in the historical record.

In order to extract lessons from this well-documented attempt to secure air superiority, and further to consider the part played by airbase attacks, this discussion is divided into three major parts:

- (1) Consideration of German planning for counter air operations, in particular, during the period from the fall of France to early September when the effort turned to attacks against London;
- (2) Identification of the forces available and the operational constraints on their employment as seen by German commanders; and,

- (3) Examination of the execution of planned operations with forces on hand.

STRATEGIC PLANNING FOR AIR WARFARE AGAINST GREAT BRITAIN

From its inception as an independent arm of the military on March 1, 1935,³ the Luftwaffe was viewed by both Luftwaffe planners and by the Wehrmacht hierarchy as primarily a continental air force. In line with the teachings of Clausewitz and of Douhet, both of whom were seen by the Luftwaffe as sources of doctrinal rectitude,⁴ the primary mission of the Luftwaffe was to suppress enemy air forces until German ground forces could occupy the territory of the enemy concerned.⁵

It is clear that this view of mission requirements would have required special modifications in the case of Great Britain; nonetheless, no detailed plans for prosecution of an air war against the British Isles existed before the beginning of 1938. Both the timing and the development of these initial plans are of interest, and demonstrate the shape of doctrinal and organizational difficulties which were to plague the Luftwaffe once the battle against Britain was actually joined.

The initial plans for operations in this critical sector were not developed by the central staff of the Luftwaffe High command but by the commander of Luftwaffe Group 2 (later *Luftflotte* 2).⁶ General Hellmuth Felmy, the commander of Luftwaffe Group 2 in 1938, stated after the war that he was assigned the task because the then-chief of the Luftwaffe "had more work than he could manage."⁷ A further rationale was that Group 2 was stationed in northwestern Germany and thus would have primary responsibility for the conduct of operations against Great Britain in case of war. Even a cursory reading of Luftwaffe doctrine confirms a German belief in the power of maneuver that is inherent in air forces, yet there were many instances of this "territorial-thinking" among senior German commanders.

The first plan was developed in response to some unspecified contingency in the west; the second was formulated in conjunction with "CASE

GREEN" (Czechoslovakia)⁸ and envisioned a conflict with the western allies resulting from a crisis over the Sudetenland.

In both of the plans, Felmy's selection of targets was somewhat at variance to the stated form of Luftwaffe doctrine. The main emphasis for the second plan, formulated in February, was to be "the ports and armament factories of London, and against the English Channel ports and air bases in Norfolk, Suffolk, and Sussex."⁹ For the plan in conjunction with CASE GREEN, the main target was stated to be the British fleet--although Felmy stated that the fleet could escape merely by sailing north beyond the range of German bombers.¹⁰ The main alternate targets were listed as "Kingston upon Hull, London, and the ground service installations of the Royal Air Force in the southeastern part of the island ..."¹¹ Felmy's plans apparently concentrated on "indirect targets," those related to strategic air warfare, and only peripherally referred to direct attacks against the enemy air force.

By September 1938, Felmy was involved in support of the development of *Plan-Studie Fall-Blau* (CASE BLUE). This long-term study was to develop plans for air war against the British Isles. Felmy included in his input to this study a judgement that, given current conditions, "air warfare against Britain could have no more than a harassing effect."¹² This statement earned Felmy a "rocket" from the High Command. The Commander-in-Chief of the Luftwaffe endorsed the memorandum as follows:

I have not asked for a memorandum weighing the existing possibilities of success and pointing out our weaknesses; these things I myself know best of all. What I asked is information on the manner in which you expect to obtain maximum effects with the projected strengths, and what conditions you require for this purpose.¹³

It could be argued that Göring was merely reacting to unwarranted assertions from a subordinate, but this statement marked the future course for the CinC of the Luftwaffe - wild swings of mood, exhortations to the flying crews, and private despair. Colonel Alan Gropman captured some of the essence of the man, "Göring lacked essential qualities of leadership. He never moved with energy and speed ... Hitler left the operation of his

key weapon in the hands of a narcotics-using amateur with insufficient energy or interest to move himself to the focus of his major operation..."¹⁴

The general interest in Great Britain did not wane with the completion of *Plan-Studie Fall-Blau*, but neither did detailed planning for full-scale operations proceed. A kind of doctrinal schizophrenia set in with the recognition that for contingencies in the West, Great Britain formed the "center of gravity of the enemy," as it would have been described in Clausewitzian terms. Despite this recognition, however, the surviving pre-war studies portray Great Britain as a target for *harassment* from the air, with the main effort directed to the allocation of airpower against other targets on the continent.

In November and December of 1938, Göring directed that a "comprehensive study" of Britain's airpower and military economic capabilities was to be undertaken. The study, also known as *Studie Blau*, was carried out by the fifth branch of the Luftwaffe General Staff during the months, January to June 1939.¹⁵ The study took the form of lectures, discussions, and interrogations carried out for several hours each week and chaired by the Chief of the Luftwaffe Intelligence Division. Erhard Milch, Reichs Minister for Aviation; Hans Jeschonnek, Chief of the Luftwaffe General Staff; and Ernst Udet, Chief of the Luftwaffe Technical Office were permanent members of the working party.

The end result of this high-level study was both broad in scope and shallow in depth. A pro forma intelligence appreciation of the RAF, dated 16 July 1940, is available and is included as Appendix B.¹⁶ For those who recognize the impossibility of attempting to characterize an entire air force in a few simple words, the quotation on "Command" is chillingly familiar:

The Command at high level is inflexible in its organization and strategy. As formations are rigidly attached to their home bases, command at medium level suffers mainly from operations being controlled in most cases by officers no longer accustomed to flying (station commanders). Command at low level is generally energetic but lacks tactical skill.

Studie Blau simply fed the mistaken preconceptions of Luftwaffe planners, but worse yet, the single-minded concentration and the centralization of intellectual effort necessary for the formulation of strategy failed to occur. Generalized discussions of the "biological strength of the English race"¹⁷ were substituted for true strategic thought.

In May 1939, the Luftwaffe Group 2 headquarters staff conducted a map exercise intended to clarify the technical requirements for air operations against England.¹⁸ The hypothetical time for the possible conflict was portrayed as the year 1942. The findings of this map exercise were supported by a situation estimate rendered by the first (operations) branch of the Luftwaffe General Staff concerning the selection of targets in the event of war with Great Britain in 1939.¹⁹

The conclusion was that neither the strength nor the training of *Luftflotte 2* was sufficient to the task. It was the considered opinion of the operations branch that small, irregularly timed, small unit attacks against the British air armament industry held out the best prospect of success, with attacks on ports and oil storage facilities scheduled as the secondary mission.²⁰

In July 1939, yet another opinion was placed in contention. Colonel Josef "Beppo" Schmid, Chief of the Luftwaffe Intelligence Branch presented his estimate of the sensitivity of the British Isles to air attack. This estimate was an extremely sober one, abundant with assumptions concerning the British character (which in the actual event proved to be substantially correct). In clear contrast to the operations branch, Colonel Schmid prioritized objectives as:

- (1) Defeat of the Royal Air Force;
- (2) Incapacitation of the British air armament industry; and,
- (3) Elimination of the British fleet.

Thereafter, in Schmid's interpretation, the Luftwaffe would be required to turn to strategic interdiction of ports and mercantile transportation. In his oral presentation, Schmid added that, despite the large forces that would be required and employed, Great Britain could not be forced to capitulate through air warfare alone and that actual occupation

of the island would be required.²¹ Schmid's suggestion about invasion is said to be the first of its nature made by a German officer. His foresight was surely based on a clear understanding of certain operational weaknesses of the Luftwaffe as well as an appreciation of British strengths. It is worthwhile to note Schmid's change in outlook in his own statement made almost exactly one year later after the heady conquests which began in Poland:

The Luftwaffe is clearly superior to the RAF as regards strength, equipment, training, command and location of bases. In the event of an intensification of air warfare the Luftwaffe, unlike the RAF, will be in a position in every respect to achieve a decisive effect this year if the time for the start of large-scale operations is set early enough to allow advantage to be taken of the months with relatively favorable weather conditions (July to the beginning of October).²²

Colonel Schmid's initial assessment of the British character under fire was to be proven correct. As he had assumed, the British populace failed to sue for peace as a direct result of the air attacks on urban centers. Instead, came the popular slogan from the Blitz - "London can take it." His prioritization of targets was clearly in line with Luftwaffe doctrine; and, as the recognition spread that invasion was in the cards, Schmid's prioritization scheme proved more realistic than the initial judgment of the operations branch. Nothing, however, had been done about incorporating such realism into the planning process. Luftwaffe planning for operations against England was no further advanced as the *Kampfgeschwadern* staged forward to their new bases in France than it had been in 1938. No fundamental decisions had been made, no strategic planning done for the destruction of the RAF. From this point on, through the development of OPERATION SEE LÖWE, the Battle of Britain itself, and the final dissolution of the plan to invade Britain in 1940, the planning would be disconnected, scattered, and ineffective.

OPERATION "SEA LION" AND THE REQUIREMENTS FOR AIR SUPERIORITY

It is beyond the scope of this presentation to deal with the campaign against the Low Countries and France. It suffices to say that by the last week in June of 1940, the battle on the continent was finished. The French *Armee De L'air* was destroyed, a third of its aircraft caught on the ground by low-level attacks in the first four days of the Battle of France.²³ The British Advanced Air Striking Force flying Bristol Blenheims and Fairey Battles which gave up more than 200 knots to the intercepting BF109's²⁴ was decimated in low-level attacks against murderous flak which covered German armored columns. More than 300,000 British soldiers, however, had escaped the port of Dunkirk and the Luftwaffe had failed miserably to fulfill Göring's unwarranted boast, "My Luftwaffe will do it alone."²⁵

In the forty days preceding the fall of France, the RAF had lost 1025 aircraft, half of which were fighters--the losses represented more than two-thirds of all aircraft deliveries since the beginning of the war. For eight years, the requirement for air defense fighters to defend the British Isles against a German attack had been calculated somewhat arbitrarily as fifty-two fighter squadrons. This calculation had not envisioned, to be sure, that the attackers would be based within thirty miles of British territory; furthermore, RAF Fighter Command did not now possess fifty-two operationally-ready squadrons.

Six first-line units were withdrawn from service to recover from the losses of Norway and France, two squadrons were effectively destroyed, five more units equipped with Bristol Blenheims were committed to night-fighter duty and were only nominally operational, and fully eleven squadrons were so newly emerged from operational conversion to Spitfires that weeks would pass before the achievement of full operational status. In short, Fighter Command could field a total of only twenty-eight fresh, combat ready squadrons, twenty-three of which were Hurricane and Spitfire-equipped.²⁶

By Britain's own calculations, the air defense situation was critical. The fighting units of the Luftwaffe were in transition from their home bases to forward bases in Holland, Belgium and northeast France

(Luftflotte 2), northwest France (Luftflotte 3), and Norway (Luftflotte 5); and, like all air forces in redeployment, suffered degradation in operationally-ready (O.R.) rates. The rebasing was being carried out, however, in benign conditions. By early July, some 2,600 combat aircraft, plus another 200 odd in Norway, faced the British defenders. On the first day of July, Luftwaffe units could muster some 1,400 operationally-ready combat aircraft in range of British targets, and they could be opposed by 640 operationally-ready British fighters and 1,063 pilots.²⁷

Despite the inherent disruption of rebasing and the relatively low O.R. rate of the Luftwaffe, the initiative lay there for the taking. The RAF was hurt and the powerful home defense radar system was ready but not yet "shaken down." The Luftwaffe had everything available but an implementable plan. Doctrine and logic both argued strongly for an immediate, powerful, and concentrated attack against Fighter Command, but at the beginning of July, 90 percent of the available striking power of the Luftwaffe sat on the ground. The dissipation of effort which had plagued the planning for strategic air operations continued.

THE BIRTH OF SEA LION

In his book, *Fighter*, Len Deighton quotes unidentified German jokers as stating after the battle that "Sea Lion was contemplated but never planned."²⁸ The historical record somewhat belies this canard; there are substantial surviving documents which prove that at least the mechanics of planning were performed by both the German Navy and the army forces which were to be committed to the invasion. The same record also indicates that very little dedicated Luftwaffe planning was undertaken. It may be argued that the basic doctrine of the Luftwaffe was directly in line with the requirements of invasion support, but the detailed, centralized, and coordinated plan which would have supported execution did not exist. What developed, while the powerful forward-based *Luftflotten* spent their efforts on uncoordinated and ill-developed attacks, was a series of undisguised

bureaucratic power plays by the other services which were mainly designed to avoid blame for possible failure and to put the onus on the Luftwaffe.

A study carried out by a special group within the Naval operations staff before the battle had set forth conditions for success:

- (1) Elimination or blockade of the enemy forces, or own naval forces must be clearly superior to those of the enemy;
- (2) Annihilation of the enemy air force;
- (3) Destruction or elimination of the opposing coastal zone forces; and
- (4) Elimination of the threat to German submarines.²⁹

The study concluded that accomplishment of these conditions would probably break the resistance of the British, in which case an invasion would be unnecessary (a curious case of circular reasoning). This was a Navy-only study, not coordinated with the Luftwaffe High Command, and no detailed planning followed these prewar deliberations. The success of the campaign against France, however, brought the subject back to the forefront.

In oral reports to Hitler on 21 May and 20 June, Admiral Raeder stated that the Navy "did not discount in principle the possibility of carrying out a landing operation." He further stated, however, that "air supremacy" was a primary condition for the landing.³⁰ It is interesting to note some of the linguistics involved in this process--Navy documents routinely refer to "*Luftheerschaft*" (air supremacy) while Luftwaffe documents refer to "*Luftüberlegenheit*" (air superiority). It was the Luftwaffe appreciation that the latter could have both temporal and spatial limits, while the former referred most directly to total destruction of an enemy's capability to mount combat air operations of any sort. It is not clear whether Naval observers recognized the same distinctions.

In early May, while the Battle of France was still underway, a conference was hosted by the National Defense Branch of the Wehrmacht at which the feasibility of an immediate cross-channel invasion was discussed by representatives of the General Staff, the Luftwaffe, the Army, and the Navy. The idea of an immediate invasion was not submitted to the Chief of

the General Staff, however, because it was judged to be outside the ruling concept of total victory over France before the initiation of subsequent operations.³¹

On 25 June, the day of the Franco-German armistice, a Luftwaffe representative in the Wehrmacht Operations Office informed the Luftwaffe Operations Staff that data on air participation in an invasion of Britain were to be submitted in a few days, and requested that his planned submission be approved. His request was denied by the Chief of the Luftwaffe General Staff, *General Oberst* Jeschonnek, who expressed the opinion that Hitler had not taken a cross-channel invasion under consideration.³²

On 30 June, two related documents which appear slightly at cross purposes were generated from two separate levels in the German military hierarchy. There is no indication as to whether these submissions were coordinated.

General Jodl, Chief of the Wehrmacht Operations Office issued a memorandum concerning the future operations against Great Britain.³³ Jodl stated that "victory over Great Britain was now only a matter of time." Jodl described, in general terms, the process by which this victory would be achieved before turning to a direct discussion of the invasion. Operations should be introduced, he wrote, "by battle against the Royal Air Force, supplemented by attacks on British supply depots, and against Britain's import and export traffic, seaborne, and in ports."³⁴

Again, the fatal blurring of objectives and diffusing of effort had begun. Jodl continued with the opinion that the goal of an invasion was not the military defeat of Britain, but merely the final denouement after Britain's "armament industry had been crippled" and her airpower rendered ineffective. It is clear that in some ways Jodl saw the task of the Luftwaffe as purely strategic air warfare, but he engaged in a curious mixture of objectives when he also expressed the opinion that the invasion could take place only after the achievement of *air supremacy* over Britain.

It had been established in previous studies that the invasion, to be successful, could wait no later than early autumn (because of weather and

tides), and Jodl knew this. In fact, on 15 July Hitler demanded that preparations be finished so that the invasion could be launched on 15 August.³⁵ Why, then, did Jodl insist on the blurring of objectives? Time was short, the forces available to the Luftwaffe were perhaps marginally capable of seizing sufficient *air superiority* to allow an invasion (but not, certainly, *air supremacy* over the entirety of Britain); and yet Jodl spoke of the destruction of the armaments industry.

His consideration shows a curious reflection of Hitler's own occasional fixations. During the Battle of France, for instance, on 6 June Hitler had diverted forces from operations against an all but prostrate enemy to "secure the Lorraine iron ore basin so as to deprive France of her armaments industry."³⁶ This confusion of generalized, long-term objectives with current, critical and non-negotiable *battle-related requirements*³⁷ plagued the Luftwaffe from the outset of the campaign against Great Britain. When it combined with the diversionary demands of the *Kriegsmarine* and the destructive neglect by Göring, the chance for an effective allocation of air power was nearly nil.

On the same day (30 June) Göring issued his general directive to *Luftflotten* 2, 3, and 5. The document directed that "until a status of complete effectiveness in all units was reached," operations were to be restricted to harassing raids by smaller formations against "industrial and air force targets." Attacks were to be carried out day and night, in weather favoring surprise approaches, by single aircraft or pairs, "and so as to avoid heavy civilian losses." This last reference is somewhat unclear and no further illumination is provided. In only a few weeks an attack on the Vickers factory at Brooklands in which only six 500 kg bombs struck the target would result in more than 700 civilian casualties, and it is obvious that no such niceties prevailed once the bomber units began night raids against the industrial targets in the Midlands.

Göring further proclaimed that reconnaissance would be followed by attacks against shipping in the Channel. The directive stated that "these attacks were to provide training for later endeavors to completely interdict all hostile seaborne traffic in the Channel."³⁸ Actual experience

during this "training" would soon convince the practitioners that interdiction of this seaborne traffic would not be a simple task.

With this mixed set of objectives, and a half-hearted directive from its own commander, the Luftwaffe commenced operations against Great Britain. On 30 June, German forces occupied the channel island of Guernsey. The battle against the British homeland was underway.

The next section of this monograph provides a brief, largely graphic description of the combat environment existing during the battle.

THE COMBAT ENVIRONMENT

This section presents a brief overview of the forces, basing, and strengths for both of the antagonists. The order-of-battle lists presented are reconstructed from a number of sources of which Karl Klee's unpublished study on OPERATION SEA LION was most useful for German strength and Francis K. Mason's *Battle Over Britain* for RAF Fighter Command.

Air Order Of Battle

It should be noted that strength figures and crew manning factors are only the grossest measures of combat capability. Many portrayals of the battle use these figures as raw means of comparison, but there are cautions in these measures which should be carefully heeded. The strength figures for RAF Fighter Command (see Appendix C) are instructive in this regard. The figures for 1 July 1940, show 905 fighter aircraft held by combat units (including the Boulton-Paul Defiant turret fighters which were to prove ineffective in combat, and the Bristol Blenheims which were almost completely devoted to nightfighter role) of which 640 were operationally ready. One thousand and sixty-three fighter pilots were reported as on-state for a crew-manning to on-hand aircraft ratio of almost 1.2 to 1.

Fighter Command was not as healthy as this simple measure would suggest though.

...No. 73 Squadron, sent north to Church Fenton to recover from its ordeal in France, had only seven pilots fully fit for operations, and every Hurricane was undergoing some measure of repair. Its ground personnel strength was still only 45 percent of establishment. No. 242 Squadron (Hurricanes), although not so heavily engaged as No. 73, was languishing at Coltishall almost paralysed through lack of spares and equipment, incapable of putting sufficient aircraft into the air to ensure adequate combat training.

No. 87 Squadron at Church Fenton, although fully strengthened with twenty-three pilots, was down to only half its ground crew establishment and possessed no qualified armourers. No. 605 Squadron had, since the outbreak of the war, flown an aged collection of fabric-winged Hurricanes and now, despite the extreme dilapidation of its aeroplanes, the Squadron was told that no chance existed of their replacement. No. 263 Squadron, decimated in the Norwegian campaign, was to all intents withdrawn from the front lines to re-equip with Westland Whirlwinds, although a Hurricane Flight was flown by the Squadron from Grangemouth for local defense. Finally, both 245 Squadron (Hurricanes) and 611 (Spitfires) were regarded as non-operational due to low strength of aircraft, and were withdrawn north to Turnhouse and Digby respectively.³⁹

By 1 July, fully eleven German bomber *Gruppen* were established in France and Belgium with more in transition to forward bases, and the Norway-based *Luftflotte* 5 was virtually completely established at its bases. The units identified by Klee are shown in Appendix C. These units were stated to be available for combat, but it is clear that not all *Gruppen* had completed their rebasing, and that after the wear and tear of the Spring campaign many of the units were suffering low rates of operational readiness.

Radar

It is difficult to overstate the impact of radar on the Battle of Britain. Together with the activities of the Observer Corps (later Royal Observer Corps), the two British home defense radar networks formed a powerful tool against surprise attack and supported a rational allocation of air defense fighter sorties.

The two cooperative nets designated "Chain Home" and "Chain Home Low" had been constructed in just five years following the demonstration in September 1935 that aircraft could be detected at fifty miles range. The first Chain Home station at Bawdsey was accepted by the Air Ministry as an operational entity in 1937. This site was followed quickly by stations at Dover and Canewdon, then in sequence by a whole series of seventeen stations which looked outward from the coast between Land's End and Newcastle. By February 1940, a further twelve Chain Home stations covering the West and the North became operational⁴⁰ (see Figure 1).

This radar network, and the communication infrastructure which was designed to support it, provided both a key operational capability for RAF Fighter Command and a critically important target set for Luftwaffe planners.

The story of the failure of the Luftwaffe to knock out the radar network is a familiar one to students of the battle. With the benefit of historical hindsight it is reasonable to point out the lack in Luftwaffe planning of any coordinated approach to this important task. There was apparently no preplanned "measure of success" against the radar network--no way to determine when to concentrate further attacks or to quit the anti-radar campaign--no facile means of coordinating between *Luftflotte* 2 and *Luftflotte* 3 at the operational level, and no way to quickly recognize tactical success.

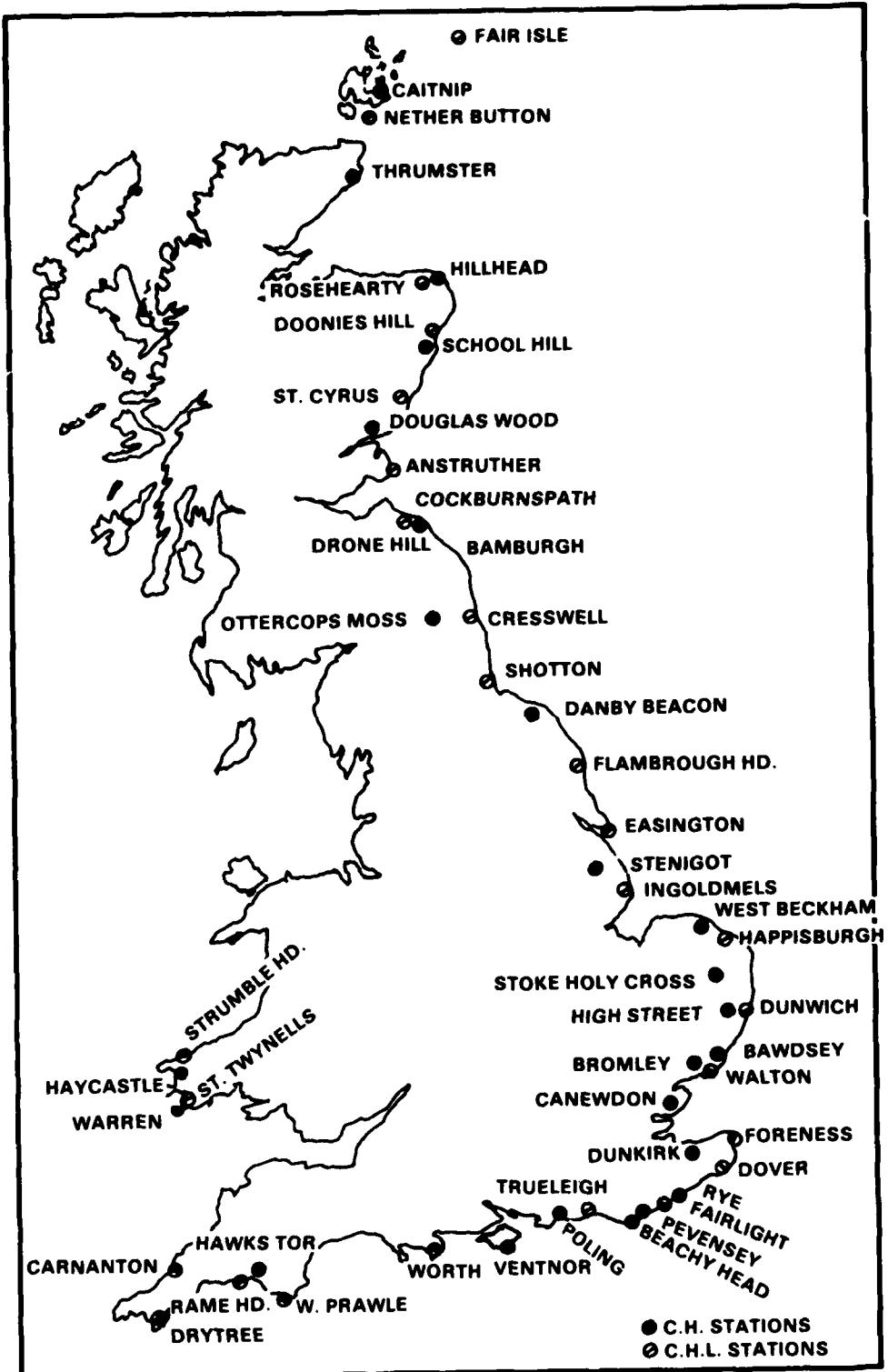


Figure 1. The radar stations of Great Britain - Summer 1940.

The Overview: Basing and Range Constraints

Figure 2 provides a general overview of the battle area. It should be noted that the coverage of "Chain Home Low" (CHL) could provide low-altitude coverage of the main cluster of German fighter bases in the Pas-de-Calais. For the attacks against convoys during July the German fighter units were able to somewhat counter the warning capability by forming up to the east of Calais below the effective coverage of "Chain Home" (CH) stations and beyond the reach of CHL. The raid assessment capability of both CH and CHL was marginal at maximum range, and "three-plus" or "ten-plus bandits" sometimes became 100-aircraft gaggles by the time they neared the coast. At any rate, however, when the attacks began against the interior RAF airfields in the battles of August, the fighter units were constrained to climb to altitude over the channel coast in order to conserve fuel and still achieve sufficient altitude to escort the bombers. In addition to the techniques of radar evasion, both *Luftflotte* commanders became adept at using the radar system to attempt to bluff Eleven Group's fighter controllers into committing scarce fighter forces against feint attacks.

The dotted line inscribed across Eleven Group represents a very rough approximation of the maximum combat radius of BF109 Messerschmitt fighters operating from the forward-most bases. The German experiments with auxillary tanks for the single seat fighters were largely unsuccessful during this period, and the necessities of aerial combat often resulted in even shorter available radius. The real penalty of this short radius was, of course, not that the target base was constrained. Indeed, all of Eleven Group's bases were within range of the fighter escort. The problem came at the other end of the flight. The RAF pilots recovering from battles could choose from a large number of main fighter stations plus numerous satellite airfields, or, at worst, parachute over friendly territory. The Luftwaffe pilots, if they strayed far from the immediate area of Dover, found that the Channel suddenly became a very wide and inhospitable body of water for

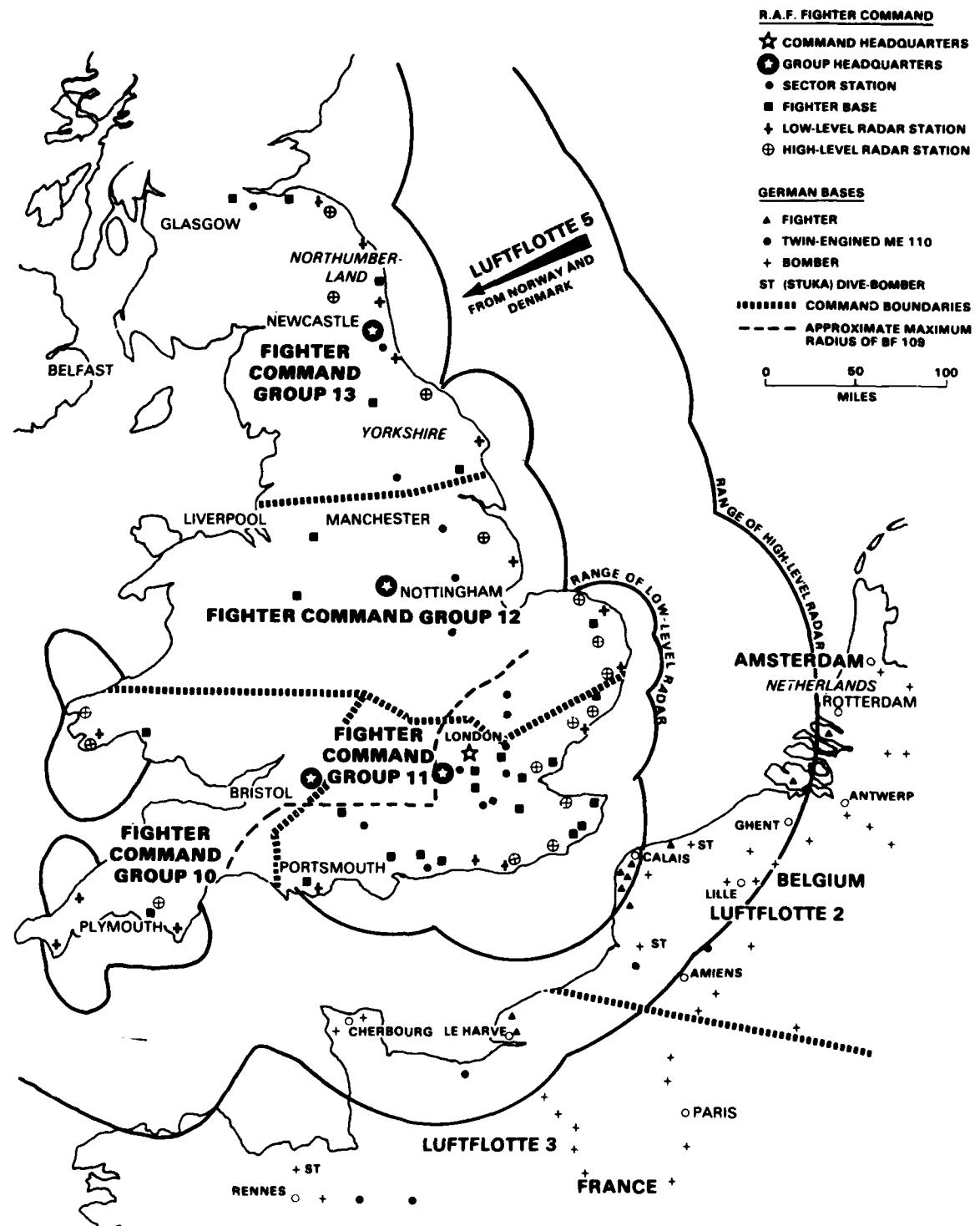


Figure 2. Combat environment.

a single-engine fighter with a flashing fuel-warning light or oil streaming from a shot-up engine.

Thus, the combat environment had its negatives and positives for both sides. The Luftwaffe's reach was short, but, on the other hand, its main accessible target, RAF Fighter Command's Eleven Group, was pinned down before it by British defense requirements and not could simply pull back to escape attacks on its basing structure. It is interesting to note that *Feldmarschall* Kesselring once suggested that the RAF would do exactly that. It was Kesselring's position by the beginning of September that the RAF could not be destroyed on the ground and thus had to be forced into air-to-air combat. He felt that even if the air base attack campaign eventually proved successful the RAF would merely pull back out of range.⁴¹ This view, of course, would be hard to justify from the British side since it would have meant a *de facto* surrender of air superiority over what was perceived as the likely and even imminent route for a cross channel invasion.

The doctrine and planning have been discussed and the combat environment has been sketched in broadly. The next section discusses the execution of the German campaign which had as its prime purpose at least the seizure of air superiority over Southeastern England, and, by extension of some German planning discussions, the destruction of British airpower.

Combat Execution

The focus of this monograph is airbase attack. The following pages contain a tabular listing of attacks against British airbases and associated targets during the period from 1 July to 7 September 1940, when the Luftwaffe's primary attention turned away from Fighter Command's airfields and toward London. The details of these attacks are compiled from a number of popular, professional, and official accounts. It should be remembered that this account deals directly only with attacks on airbases, but allied topics are presented when they appear to have a bearing on the execution of airbase attack campaign.

It would be simple and convenient to ascribe all of the campaign decisions to some particular military architect, but when the airbase attack campaign of the summer of 1940 is viewed from the tactical level it is clear that such was not the case. There was no single architect, nor, it could be argued, even a small group of architects of the combat design. It is clear enough that a "campaign" was underway--even the *Luftflotte* commanders themselves saw their activities as part of a concerted effort to gain air superiority. But the actual selection of targets, the decisions on relative target priorities, and the critical decisions on concentration of attacks versus harassment were all made at the *Geschwader* level.

This devolution of operational authority was not apparently a failure of the command structure. The organization of a *Luftflotte*, with its subordinate *Fliegerdivision* (Air Division) and *Jagdfliegerführer* (Fighter Headquarters), was well suited for the command of composite operations. Nor was the problem lodged in inadequate communications. The surviving evidence provided by ULTRA decrypts based on the Luftwaffe "Red Key" proves that inter-*Gruppe* communications (which were believed to be secure by German commanders) were amply available.⁴² The real reason for this abnormally low level of campaign planning was that *there simply was no overarching plan for gaining air superiority over the British Isles*. The Luftwaffe response to the requirements of OPERATION SEA LION was to continue business as usual. Klee states that as late as 27 August 1940, the Luftwaffe high command had completed no detailed plans for air support of SEA LION.⁴³ The rationale for this was that the requirements of SEA LION were congruent with the general directives of the Commander-in-Chief of the Luftwaffe, and, in any case, airpower was so inherently flexible that any new requirement could be accommodated with little difficulty.

The general directive of the Commander-in-Chief, however, was that document promulgated by Göring on 30 June (bits and pieces of which kept showing up in ULTRA throughout the summer).⁴⁴ Göring's directive did not lend itself to any further clarification as it percolated toward the lower levels, and so operations against Britain opened and continued for more than a month with only the most general guidance. Göring's interventions

in the conduct of the campaign were aptly summed by General Freiherr von Richthofen in a note, entered in his diary after a full-scale meeting of the senior commanders with Göring on 19 August, "The campaign against England is to proceed energetically but differently."⁴⁵

Airbase Attacks - July

The whole month of July passed with almost no activity against the bases and satellites of RAF Fighter Command. The greatest share of attention was paid to channel convoys, fighter *frei Jagd* or "free chases" designed to probe defenses, relatively uncoordinated reconnaissance sorties and sharp attacks against Portsmouth, and scattered, unescorted bomber attacks over the Midlands.

It is interesting to note that during this period German fighter pilots spotted the high incidence of successful reaction to the "free chases" and concluded that Fighter Command was mounting standing patrols.⁴⁶ The secret of the radar direction net was not yet unlocked, although the German signal intelligence units had begun to realize that British fighters were being directed from the ground with some precision.

This "grace period" of almost six weeks (the concentration of attacks against Fighter command facilities did not really begin until about 12-13 August) was critical in regaining operational health in the RAF fighter units. Kesselring and Sperrle acquiesced to the Navy's demand for concentration on convoys and ports, partly because it could be demonstrated to their satisfaction that these attacks forced the British fighters to accept battle and subjected them to some air-to-air attrition. The serious overestimation of aerial victories, and the failure to recognize how fast reconstitution of formerly weakened units was progressing, led them to believe that their goal of destroying Fighter Command might be achieved without attacking the bases. In fact, the failure to directly attack Fighter Command was having an altogether salubrious effect. On 1 August, Air Chief Marshall Dowding reset the Unit Establishment (U.E.) strength of Fighter Command squadrons at twenty aircraft (U.E. had been set at sixteen

following Dunkirk), and on the basis of an actual strength return of 1,414 pilots increased the Command authorization from 1,454 to 1,588, thus creating a "paper shortage."⁴⁷ In fact, Fighter Command was far better off than it had been in early July, and although a shortage in flying personnel would once again develop in September as a result of the concentrated German attacks of August, the shortage would be based on the higher establishment strength. The opportunity for a knockout blow, if indeed it had ever existed, was slipping past.

Luftwaffe Operations Against Great Britain, July 1940

DATE	TARGET	ATTACKING UNIT	NUMBER + TYPE	ORDNANCE	RESULTS/ REMARKS
1 JUL	KENLEY	2/KG77	1 DO-17		Intercepted- Destroyed
	Homebase 64				
	Sqn (Spit- fire)				
	Homebase 615				
	Sqn (Hurri- cane)				
	Sector HQ				
	Kenley				
	Sector of 11				
	Group				
3 JUL	MANSTON		DO-17	Light Bombs	
No damage Except					
	Homebase 600				Destruction of
	Sqn (Blen- heim)				airfield mowing machines.

Airbase Attacks - August

The airbase attack campaign which, by the Luftwaffe's own doctrine, should have been the *sine qua non* for operations against Britain began to

gather momentum in the second week of August. Göring's promise to shatter the RAF, and perhaps even defuse the nearly insoluble problems of a cross-channel invasion, hinged on an intense counter air attack which he grandly called *Adler Angriff*, "Attack of Eagles." On 1 August 1940, Hitler issued a directive designed to specify the operations of the Luftwaffe and *Kriegsmarine*:

Directive #17
For the Conduct of Air and Naval Warfare
Against England⁴⁸

For the purpose of creating conditions for the final defeat of Britain I intend continuing air and naval warfare against the English motherland in a more severe form than hitherto.

For this purpose I order as follows:

- (1) The *Luftwaffe* will employ all forces available to eliminate the British air force as soon as possible. In the initial stages, attacks will be directed primarily against the hostile air forces and their ground service organization and supply installations, and against air armament industries, including factories producing AAA equipment.
- (2) Once temporary or local air superiority is achieved, operations will continue against ports, particularly against installations for the storage of food, and against food storage installations farther inland. In view of intended future German operations, attacks against ports on the south coast of England will be restricted to a minimum.
- (3) Air operations against hostile naval and merchant ships will be considered a secondary mission during this phase unless particularly lucrative fleeting opportunities offer or unless such action will achieve increased effects in the operations prescribed under Item 2, above, or in the case of operations serving to train aircraft crews for the continued conduct of air warfare.
- (4) The intensified air offensive will be so conducted that adequately strong air forces can be made available whenever required to support naval operations against favorable fleeting targets. In addition; the *Luftwaffe* will remain prepared to render effective support for Operation Sea Lion.
- (5) Terrorization attacks as retaliatory measures will be carried out only on orders from me.
- (6) Intensified air warfare can commence at any time from August 5 on. The *Luftwaffe* will itself determine the deadline after completion of its preparations and in accordance with weather conditions.

s/Adolf Hitler

Two days prior to the issuance of the Hitler Directive, Göring had been directed by *Ober Kommando der Wehrmacht* to make preparations so that a major air offensive could be launched within twelve hours of receipt of an authorizing directive. The directive was not in hand, and the *Luftflotten* on the frontline were still a long way from having completed the planning to support a concerted operation. Part of the blame could be laid to Göring himself. The Commander-in-Chief of the Luftwaffe had operated under the assumption that the deadline for the commencement of intensified operations was still some eight days away.⁴⁹

The Luftwaffe estimated that five or six days would now be needed for finalizing plans, plus there was the matter of the weather to be considered. Goring's initial instructions had constrained attacks to "weather favoring surprise approaches." For the concentrated operations now envisioned good weather was a firm requirement. The first forecast set *Adler Tag* (Eagle Day) for 10 August, and then allowed it to slip to the thirteenth.

The Anti-Radar Attacks

Preparations for *Adler Tag* began on 12 August with a series of sharp attacks on selected radar sites by the specialist unit *Erprobungsgruppe 210*. This operational trials unit operated with distinction throughout the battle but the effects of its attacks on the critical radar network were "lost in the noise" of the larger effort.

Devotion of sorties to destruction of the radar system was the work of General Wolfgang Martini, Chief of the Luftwaffe Signals Service, and was based on a largely correct assessment of the operational value of the CH and CHL stations to the direction of Fighter Command.⁵⁰ Martini argued successfully that the large fixed installations represented a lucrative target for precision attacks by the Luftwaffe. On 3 August a directive to *Luftflotten* 2 and 3 stated "Known English DeTe⁵¹ stations are to be attacked by special forces of the first wave to put them out of action."⁵²

The first attack, on 12 August, must be judged an overall success. ErprGr 210 struck four Chain Home stations while Ju88's of KG51 knocked out the site at Ventnor. Transmissions were resumed from four of the sites within a few hours, but the site at Ventnor had suffered damage to the antenna tower itself and it was three days before makeshift equipment could be brought on line. What the Germans did not understand was that the gap-filler transmitters being brought into service were not always surveyed-in and technically wrung out. Because of the structural damage at Ventnor, range determination from that site was apparently precluded for as long as eleven days.⁵³

It is claimed by Bekker that disappointment spread through the Luftwaffe planners, and that the conclusion was drawn that the radar net could only be degraded for periods of two hours or so by these dedicated attacks. It is not true, however, as is claimed in some accounts, that the anti-radar campaign immediately ceased. ErprGr 210 continued to successfully strike the sites throughout the battle. What actually happened was that no tactical advantage was gained from these attacks. On 30 August a lucky bomb on a main commercial power grid knocked out the radar service for all of southeastern England, but attacks of the afternoon penetrated directly into the area still covered by active radar.

The anti-radar component of *Adler Angriff*, and the succeeding days of operation, might well have worked but for several gaps in German preparations:

- (1) There was no apparent understanding of "measures of effectiveness" which would have reliably portrayed success.
- (2) SIGINT support to the attacks was designed only to determine whether there were "decimetric telegraphy" emissions on the 1,200 centimeter band--not whether the control functions carried on VHF radio were degraded.
- (3) It is not clear whether the vulnerability of the vital- and soft- Transmit/Receive buildings at the base of the Chain Home antenna arrays was correctly assessed. (It is, of course, arguable whether bombing accuracy would have been sufficient to allow

directed attacks on these buildings, but it is stated in secondary sources⁵⁴ that the target for ErprGr 210 was the lattice-work antenna towers themselves). The same problem existed in the attacks against the sector control stations where the German targeteers assumed incorrectly that the sector control facility was a hardened underground structure when, in fact, it was a normal and identifiable airfield structure.

- (4) Finally, the attacks of 30 August suggest that even when large portions of the network were knocked out, German tactical flexibility to redirect sorties to take advantage of that fact was missing.

Raid Timing

During the attacks of August the *Luftflotte* commanders displayed a sound tactical grasp of the potential value of exploiting the RAF Fighter Command's "sortie cycle rate." It was clear to both Sperrle and Kesselring, that with their respective *Luftflossen* operating on relatively short distance axes, that if major fighter reactions could somehow be provoked, then the British force might be destroyed on the ground by a bomber attack planned to arrive just after the fighters recovered. Some major attacks (notably on 15 August) were planned on this basis, but the results were generally disappointing to Luftwaffe commanders. The prime factors in this were twofold: the German appreciation of the RAF operating style in regards to forward fields and satellites was faulty (see Appendix B); and the ubiquitous radar warning, the Observer Corps, and the skill of fighter sector controllers in ordering scrambles and allocating sorties meant that few fighters could be caught on the ground.

A primary victim of attacks against the main RAF facilities was the Bristol Blenheim, most of which were carried in the nightfighter role. It remains a puzzle why there were few night attacks against RAF Fighter Command dayfighter bases. Specialist units such as the pathfinder *Kampfgruppe* 100 demonstrated the operational capability to reliably locate

and attack targets smaller than an airfield with the assistance of the bomb/navigation systems known as *Knickebein* and *X* and *Y Gerät*, and counter-measures against these systems were not yet perfected during the battle. It seems likely that a dedicated series of night attacks might have achieved substantial success against the dayfighter bases. The Spitfire and Hurricane units were not well equipped to deal with night intruders, and the nascent nightfighter units would have been quickly overwhelmed by concentrated raids.

Target Selection

On 13 August, *Adler Tag*, and succeeding days, the Luftwaffe units convincingly demonstrated some serious gaps in intelligence preparation for the concerted airbase attack program. Part of the problems revolved about the failure to understand the RAF organization, and part were caused by simple misidentification of aircraft types. While operational planning and requirements clearly called for a massed attack against fighter stations, some attacks were frittered away on Coastal Command bases, empty dispersal bases, and maintenance units holding no operational aircraft. The crucial problem again, however, was that no means existed for raid planners to determine what was working and what was a mistake. Reliance on post-combat debriefings and overestimates of success finally led to Kesselring's remark that he was facing the "last fifty Spitfires" of the RAF.⁵⁵

The Campaign Winds Down

At the critical juncture a two-step decision led to the end of the counter-airfield campaign. By the last week of August, RAF Manston was out of action for anything other than "gas and go" operations; and on 1 September, six out of the seven airfields in the Biggin Hill Sector were heavily damaged along with five satellite airfields. Kesselring and Sperrle had come as close as they ever would to destroying Fighter Command

and on this day the emphasis of attacks began to shift to the British aircraft industry.

Luftwaffe Operations Against Great Britain, August 1940

DATE	TARGET	ATTACKING UNIT	NUMBER + TYPE	ORDNANCE	RESULTS/REMARKS
12 AUG	Dover CH	ErprGr 210	4 Bf 110	500 KG Bombs	
12 AUG	Rye CH	ErprGr 210	4 Bf 110	500 KG Bombs	Bombs detonated among compound huts but missed Transmit/Receive huts.
12 AUG	Pevensey CH	ErprGr 210	4 Bf 110	500 KG Bombs	Bombs cut power transmission cables.
12 AUG	Dunkirk CH	ErprGr 210	4 Bf 110	500 KG Bombs	Bombs within the compound but no serious damage. Attack by Erprobungsgruppe 210 briefly knocked Dover, Pevensey and Rye off the air all radar service restored within 6 hours.
12 AUG	Lympne Fighter Command forward satellite			141 Bombs	Lympne had been used as a Fighter Command emergency satellite field since June 1940. No serious damage.
12 AUG	Hawkinge	II/KG 76	-JU 88		Destroyed 2 hangars, station maintenance workshops, 4 Hurricanes
12 AUG	Ventnor CH	KG 51	15 JU 88	15 500 KG	All 15 Bombs detonated within the compound demolishing every building and severely damaging the transmit antenna. Ventnor CH was knocked out for about 72 hours before makeshift reporting resumed on 15 August.
12 AUG	Mansion Homebase of 600 Sqdn (Blenheim) and forward recovery base for 11 Group	ErprGr 210 KG 2	Bf 110 18 DO 17	250 KG Frag	Coordinated attack with ErprGr 210. Attacking low-level and DO 17's bombing level from medium altitude. About 150 bombs hit the airfield. German crews reported Manston destroyed. Actual damage included 1 Blenheim destroyed on the ground, station workshops gutted, and two hangars destroyed. No Spitfires were hit, but damage to the unpaved runway prevented operations for about 24 hours.
13 AUG	Eastchurch temporary location for 266 Sqdn (Spitfire) homebase for 35 Sqdn Costal Command (Blenheim)	KG 2	30 DO 17	100+ HE and Incendiary Bombs	16 killed, all hangars hit, 266 Sqdn hangar set on fire, one Spitfire destroyed, All Sqdn ammunition, and much equipment destroyed, water supplies damaged. Operations block of 35 Sqdn destroyed, 48 injuries, five Blenheims destroyed.
13 AUG	Warmwell home- base 152 Sqdn (Spit- fire) and Central Gunnery School	StG 77	Ju 87		Aircraft failed to find their target, bombed at random.

DATE	TARGET	ATTACKING UNIT	NUMBER + TYPE	ORDNANCE	RESULTS/REMARKS
13 AUG	Middle Wallop base for 238 Sqdn (Hurricane) 609 Sqdn (Spitfire) 604 Sqdn (Bleheim)	II/StG 2	9 Ju 87		Ju 87's without escort intercepted by 609 Sqdn, 6 of 9 Stukas destroyed, no damage to airfield.
13 AUG	Detling Costal Command Base	IV(Stuka)/ LG 1	40 Ju 87		Bombed at 17.16 hours as station personnel were gathered for evening meal. Three messes demolished, Operations block destroyed. Station commander killed, 67 service and civilian personnel killed. Runways, taxiways, and hardstands cratered, 22 aircraft destroyed on the ground.
13 AUG	Andover Dispersal Base	LG 1	12 Ju 88		Damage to grass runway but no significance to Fighter Command. This attack may have been intended for Middle Wallop.
13 AUG	Rochester deployment base 41 Sqdn (Spitfire) (from Hornchurch)	IV (Stuka)	Ju 87		Target not located. Aircraft randomly bombed Lympne with no further damage.
14 AUG	Manston	1 and 2/ ErprGr 210	(20+) Bf 110	50+He	3 Blenheim destroyed, 4 hangars, 50 runway craters.
14 AUG	Middle Wallop	Stabskette/ KG 55	3 He 111	500 KG Fragmentation	609 Sqdn's hangars bombed. A 500 KG bomb struck a hangar holding Spitfires, no aircraft losses reported.
14 AUG	Colerne Maintenance unit holding Hurricanes for repair	KG 27	He 111		No operational aircraft at this field, no appreciable damage.
14 AUG	Sealand base of number 30 maintenance unit	KG 27	3 He 111		No operational aircraft. Some temporary damage to air base facilities.
15 AUG	HAWKINGE Forward staging for 501 sqdn (Hurricane on this day	IV(Stuka)/ LG 1	2 Staffeln Ju 87	500 KG 250 KG Predominant use of 50 KG frag	Raiders intercepted over the airfield by 11 Hurricanes of 501 sqdn plus 12 Spitfires of 54 sqdn. One hangar demolished by a 500 KG bomb, one barracks block damaged. Bomb strikes outside the airfield severed a sub area power cable putting CH stations at Dover and Rye and the CHL station at Foreness off the air. Munitions selection (predominant loads of 50 KG frags) suggests the intent to

DATE	TARGET	ATTACKING UNIT	NUMBER + TYPE	ORDNANCE	RESULTS/REMARKS
15 AUG	Lympne	II/StG 1	26 Ju 87	light frag bombs	destroy aircraft on the ground. The Hurricane of 501 sqdn scrambled "on a hunch" escaped any destruction on the ground.
15 AUG	Manston Recovery base for 54 sqdn (Spitfire) earlier on this day	II/ZG 76	12 Bf 110	Cannon and machinegun fire	This raid was unopposed. Most of the buildings not damaged in the 12 August raid were destroyed. Again, no aircraft were caught on the ground.
15 AUG	Driffield Bomber command base (Whitley) of 4 Group	KG 30	50 Ju 88	Frag bombs	16 casualties, 2 Spitfires of 54 sqdn destroyed on the ground.
15 AUG	Martlesham Homebase of 25 sqdn (Blenheim). On this day dispersal for 17 sqdn (Hurricane) from Debden	ErprGr 210	Bf 110 and probably Bf 109 of 3./ ErprGr 210 total 25 aircraft	About 30 Frag Bombs	10 Whitley bombers destroyed on the ground. Fighter command believed this raid was intended to hit fighter bases Leconfield and/or Church Fenton. Raiders were under attack by about 18 Hurricanes and Spitfires when they turned to attack Driffield. Bekker states Driffield was the briefed target.
15 AUG	Rochester Fly away field for Short Brothers. No operational aircraft	Stabskette, I and II/ KG 3	Up to 40 DO-17	300 + frag bombs many delayed action	18 bombs among station buildings, one Fairey Battle destroyed on the ground. Hits on station workshops, officer's mess, water and telephone services. Station out of operation for 48 hours.
15 AUG	Hawkinge, Maidstone, Rye CH, Dover CH Foreness CHL	KG 1 and	He 111 and DO 17		This raid also struck the Short Brothers Aircraft factory disrupting production of the Stirling aircraft. Scattered raids under cover of disruption of free chase fighter sweeps and previous disruption of the CH and CHL radar network.
15 AUG	Middle Wallop	LG 1	30 Ju 88		Little damage.
15 AUG	Worthy Down	LG 1	30 Ju 88		Little damage.
15 AUG	Croydon Commercial airport- see notes	ErprGr 210 (Second major attack of the day by this unit)	15 Bf 110 8 Bf 109	Frag bombs, some delayed action	68 killed, 192 wounded, widespread destruction of airfield buildup. The actual briefed target for this raid, however, was the sector station at Kenley. ErprGr 210 attacking without fighter cover missed the primary target. The raiders were intercepted by 111 Sqdn and the commander of ErprGr 210 was shot down and killed.

DATE	TARGET	ATTACKING UNIT	NUMBER + TYPE	ORDNANCE	RESULTS/REMARKS
15 AUG	West Malling Airfield still under construction, not yet integrated into defenses	KG 2 ?	DO 17		The briefed target for this attack was Biggin Hill. This attack was carried out in conjunction with the intended attack on Kenley by Erpr Gr 210.
16 AUG	West Malling	KG 2	2 Staffeln 80 + HE DO 17		1 Lysander destroyed on the ground. The field was put out of action for 4 days. The rationale for this successful attack is unclear. No fighters were operating from this yet unfinished airfield.
16 AUG	Probably Hornchurch	II/KG 2	24 DO 17		Attack intercepted and driven off by 54 Sqdn.
16 AUG	Harwell,	KG 2	DO 17		Scattered bombing.
16 AUG	Tangmere, VENTNOR CH, Gosport Royal Navy field Naval air-field at Lee-on-Solent	StG 2 JG 2 KG 54 III/ZG 76	100 + aircraft consisting of Ju 87, 12 Ju 88 of KG 54, Bf 110 of ZG 76 and JG 2 Bf 109 in escort		This large raid approached the Isle of Wight at 1300 and broke up to attack the various targets, details follow.
16 AUG	Tangmere	StG 2			All hangars hit, station workshops, stores, water plant, Officer's mess, transport section, all of Fighter Interception Unit (Blenheim) damaged or destroyed plus RAF Fighter Command's first radar equipped Bristol Beaufighter damaged, 7 Hurricanes and some Spitfires undergoing repair or maintenance were heavily damaged and subsequently written off. 14 military and 6 civilians killed, 41 severely injured.
16 AUG	Ventnor CH	StG 2	5 Ju 87	22 Bombs	Ventnor knocked out for a further 7 days. Degraded backup coverage provided by a mobile unit at Bembridge.
16 AUG	Lee-on-Solent Naval air station				Bombing and strafing destroying 3 hangars and 6 naval aircraft on the ground.
16 AUG	Gosport Naval air station	KG 54 and III/ZG 76	12 Ju 88 18 Bf 110 (These were bomb-carrying Bf 110 received sometime in July by ZG 76)		Some damage and 6 casualties.

DATE	TARGET	ATTACKING UNIT	NUMBER + TYPE	ORDNANCE	RESULTS/REMARKS
16 AUG late after- noon	Manston		8 Bf 109	Machinegun and cannon	Strafing attack in conjunction with a free chase. One Spitfire and one Blenheim destroyed on the ground.
16 AUG	Biggin Hill	KG 27 Escorted by Bf 110's	HE 111		Raid broken up and driven away by Hurricanes of 1 and 615 Sqdn and Spitfires of 64 Sqdn.
16 AUG evening	Brize-Norton Base of number 2 Flying Training Sqn plus maint unit	Unk	2 Ju 88	32 Bombs at least 2 250 KG	Ju 88's appeared in the airfield circuit with landing gear down then bombed the main hangars. Fueled training aircraft exploded destroying 46 aircraft and damaging 7 others. Eleven Hurricanes in the resident Maintenance Unit were also damaged.
16 AUG	Debden, Duxford, North Weald, and Hornchurch	II/KG 76, II/KG 1, III/KG 53 I/KG 2			Bekker states these targets were briefed but raiders failed to find their targets due to clouds.
18 AUG 1300	Biggin Hill	9./KG 76 and II/KG 76	9 DO 17 30 Ju 88		KG 76 aircraft were to participate in a two-level attack delivering bombs from low level while Ju 88's bombed from medium altitude. In the event, the rendezvous was missed and the DO 17's attacked alone followed sometime later by Ju 88's. The later attack cratered the runway.
18 AUG	Kenley Base of 615 Sqn (Hurricane) and 64 Sqn (Spitfire)		DO 17 and Ju 88 (30 + aircraft	100 + He Bombs	Another two-level raid, this one successful. The attacking aircraft were subjected to "fire" from the Parachute and Cable installations which defended Kenley and were intercepted by 615 Sqn after the attack. Ten hangars destroyed, equipment stores, 10 Hurricanes, 2 Blenheims, destroyed. 5 other aircraft damaged. All communications were cut, gas and water mains severed outside the station. An air raid shelter trench was hit. Twelve station personnel were killed and twenty wounded. Six of the destroyed Hurricanes belonged to 615 Sqn and five more 615 aircraft were shot down during the air battle. The remaining 615 aircraft were diverted to Croydon, but the 54 Sqn Spitfire managed to land at Kenley on a crater-free strip marked out on the runway by white flags. The use of the parachute and cable installations (rockets which carried a cable aloft to descend by parachute in hopes of entangling attacking aircraft) provoked a report by the local police that Kenley was under assault by paratroopers. Because of widespread disruption of telephone lines it was more than two hours before Fighter Command could be informed of the location and status of surviving fighters.

DATE	TARGET	ATTACKING UNIT	NUMBER + TYPE	ORDNANCE	RESULTS/REMARKS
18 AUG 1500	Croydon		11 Bombs		This attack delivered by Ju 88's and DO 17's which failed to reach Kenley. One previously undamaged hangar was destroyed. One Hurricane damaged, one destroyed. West Malling was also bombed again by stragglers.
18 AUG 1400	Poling CH, Ford Naval Air Station, Gosport Naval Air Stations, Thorney Island (Coastal Command Base)	I/StG 77 II/StG 77 III/StG 77 KG 54	28 Ju 87 27 Ju 87 30 Ju 87 25 Ju 88		Expecting another attack on a Sector station like that on Tangmere on 16 August, the sector controller scrambled sqdns into airborne patrol over their own bases. This allowed the attackers to penetrate to their targets. Gosport was hit heavily once again. Ju 87's of I/StG 77 were intercepted by Hurricanes as they began their formation dive against the Poling CH station. The CH station was knocked out and was off the air for more than a week while a "remote site" was brought into operation to fill the gap and mask the damage to the CH network. Hangars, a fuel dump and aircraft were hit at Ford and Thorney Island. This raid marked the end of the Stuka's operations against Britain. I/StG 77 was separated from its escort (I and II/JG 27) during the attack on Poling and when the 3 Gruppen attempted to reform for the homebound flight they were set upon by Hurricanes and Spitfires from 152, 601 and 602 Sqdns. Lost and damaged aircraft across the entire Stuka Geschwader reached nearly 30% on this single raid.
18 AUG 1530	Manston		12 Bf 109	Machinegun and cannon fire	Strafing attack preceding a major raid on airfields in Kent. Two Spitfires destroyed, one ground crewman killed, 15 mostly in the servicing flight wounded.
18 AUG 1700	Probably Croydon	5 Separate forma- tions from Luft- flotte 2			Aircraft were intercepted by two RAF Sqdns and driven off.
20 AUG	Martlesham	ErprGr 210	Bf 110		Bombs fell wide, no apparent damage.
21 AUG	Horsham St. Faith Base of 114 Sqdn (Blenheim) of Bomber Command during Aug 1940				
	St Eval base of 236 Sqdn (Blenheim) on this		1 Ju 88	6 Bombs	Hangar destroyed. Four Blenheims damaged, 3 destroyed by this single aircraft attack. These two attacks (Horsham St. Faith and St Eval) were part of a pattern of harassing attacks

DATE	TARGET	ATTACKING UNIT	NUMBER + TYPE	ORDNANCE	RESULTS/REMARKS
	day				
20 AUG	Manston	Maybe KG 2	DO 17		intended to keep the pressure on sector controllers and induce them to scramble aircraft against even minor raids.
22 AUG 1850	Manston (On 21 August 600 Sqdn had moved its Blenheims to Horn- church)	Erpr Gr 210	Bf 110	6 "heavy bombs	600 Sqdn personnel were engaged in packing up ground equipment to follow the move of Sqdn aircraft to Hornchurch. Bombs struck hangars, radio stores, and the Sqdn offices. No casualties.
22 AUG late evening	St Eval		1 Ju 88		Strike on pyrotechnics store.
23 AUG	Manston				Raiders bombing through cloud missed base facilities but severed both domestic and operational phone communications.
23 AUG evening	Thorney Island Coastal Command Base		3 Ju 88		Little damage, no casualties.
23 AUG night	Croydon Holding 85 Sqdn (Hurricane)				2 Hurricane damaged, one destroyed.
24 AUG					This date marked the beginning of a further concentration against 11 Group's airfields. A number of Jagdgeschwader were transferred from the bases in the Cherbourg area to the Pas de Calais area. With this transfer a tactic of "enticement" was initiated with nearly continuous streams of aircraft in tracks parallel to the Sussex coast attempting to force the controllers to scramble squadrons in reaction so their bases might be attacked when they landed to rearm and refuel.
24 AUG mid day	Manston	II/KG 76	Ju 88		This raid finally put Manston out of operation for anything but a forward refueling satellite. Seventeen casualties, all living quarters destroyed, 3 aircraft damaged. Communications with 11 Group disrupted. Chalk dust and smoke so obscured the target that some raiders bombed a sport flying field at Ramsgate.
24 AUG mid after- noon	Hornchurch House base of 54 Sqdn (Spitfire) and on this day hosting 264 Sqdn (Defiant)	III/KG 53	HE 111 Ju 88		HE 111's bombing from 12,000 feet.

DATE	TARGET	ATTACKING UNIT	NUMBER + TYPE	ORDNANCE	RESULTS/REMARKS
24 AUG mid after- noon	North Weald 151 Sqdn (Hurricane)	III/KG 53	46 HE 111 + DO 17 from unidentified unit		Twenty bombers succeeded in breaking through the fighter screen of 151 Sqdn. Bombs hit the married quarters, stores, and two mess facilities. The operational capability fo the field was not seriously disrupted.
26 AUG	Biggin Hill 610 Sqdn. (Spitfire)	KG 3 KG 1 ? JG 53	12 DO 17 + 40 HE 111 80 + Bf 109 and Bf 110 in escort		Turned away before reaching the target.
28 AUG	Debden 257 Sqdn (Hurricane) and Horn- church 264 Sqdn (Defiant) & 54 Sqdn (Spitfire)	KG 2, KG 3	80 DO 17, 40 Bf 109 and 80 Bf 110 in escort		Forty DO 17's and 40 Bf 110 proceeded directly toward Debden while 40 DO 17's, 40 Bf 109's and 40 Bf 110's swung onto a course toward Hornchurch. These large formations were broken up and turned back with Bf 109's operating at their range limit. Six to eight DO 17's got through to Debden. One Hurricane severely damaged, 3 killed. Sergeant's mess, transport yard and store were hit.
28 AUG 0900	Eastchurch	I/KG 3 ESCORT I and III/JG 51	23 DO 17 60 + Bf 109	100 + bombs	Several light bombers of Coastal Command destroyed. These raiders flew together with a formation bound to attack Rochford.
28 AUG	Rochford	II and III/ KG 53	27 HE 111		Little damage at Rochford, partly because of airfield defenses.
28 AUG 1235	Rochford	II and III/ KG 3	30 DO 17		Penetration up the Thames estuary at 18,000 feet.
					A third raid of the day formed up in the 1600 hour. 11 Group Controllers fearing a repeat reacted heavily. This time the formalion was all Bf 109 and Bf 110, eleven fighter Gruppen in total. This fighter-to-fighter battle was what Park had attempted to avoid. Reaction was forced by the expectation of yet another airfield attack. On 29 August Luftflotte 2 tried the same trick in spades. In the 1600 hour a small number of DO 17's and HE 111's approached the coast between Beachy Head and Hastings escorted by no less than 500 fighters. Fighter Command studiously avoided major reaction.
29 AUG					The lack of any concentrated attacks during the daytime allowed Dowding to further shuffle the defenses. Number 264 Sqdn was transferred from Hornchurch to Kirton-on-Lindsey and was replaced by 19 Spitfires of 222 Sqdn from that airfield. Ten remaining Hurricanes of 615 Sqdn exchanged places with 18 Hurricanes of 253 Sqdn from Prestwick.

DATE	TARGET	ATTACKING UNIT	NUMBER + TYPE	ORDNANCE	RESULTS/REMARKS
30 AUG 1030 onwards	Biggin Hill		Approx 20 Ju 88	250 KG de- layed action 30 + bombs	The raid commenced with about 60 Bf 109 in a free chase over the Kent coast to which 11 Group did not react. At about 1100 hours some 40 HE 111's, 30 DO 17's, 60 Bf 109's, and 30 Bf 110's began crossing the coast. The Staffel- strength raid on Biggin Hill was part of this attack. The use of only delayed action bombs may have represented an attempt to force rebasing away from Biggin Hill or destruction of recovered aircraft. In the event most of the bombs landed in small villages outside the air base.
30 AUG					Note - during the morning attack a lucky bomb on the main electricity grid knocked out the radars of the CH and CHL nets at Beachy Head, Dover, Fair- light, Foreness, Pevensey, Rye, and Whitstable. There is no evidence that Luftwaffe commanders had knowledge of this situation since the late afternoon attacks against airfields approached up the Thames estuary in view of still functioning CH and CHL stations.
30 AUG 1600	Biggin Hill	II/KG 76?	Ju 88	16 500 KG Bombs	Ju 88's bombed from below 1000 feet. The 16 bombs fell among the remaining station buildings, telephones, gas, water and electricity were knocked out, one hangar destroyed, Hornchurch took over temporarily as sector control.
31 AUG 0900	North Weald, Debden, Duxford	II and III KG 2 JG3 and ZG 26	Approx 200 aircraft		The raid on North Weald was turned back with light damage to the airfield.
				100 + 250 KG Bombs struck Debden	Four Hurricanes were badly damaged on the ground, three barracks blocks damaged, eighteen casualties. The operational capability of the airfield was not seriously impaired.
31 AUG 0900	Eastchurch Homebase of (12 Sqdn (Battle) of RAF Bomber Command from Aug to Sep 1940	20 DO 17 with escort plus a separate group of Bf 109 from I/JG 52 and Bf 110 possibly ErprGr 210	80 + Bombs		Limited damage. The separate group of Bf 109 and Bf 110 Strafed the airfield at Detling (base of the Fleet Air Arm). Early in the battle German photoreconnaissance had mistakenly identified aircraft on this base as Hurricanes of fighter command when in fact there were Skua and Swordfish of the Royal Navy.

DATE	TARGET	ATTACKING UNIT	NUMBER + TYPE	ORDNANCE	RESULTS/REMARKS
31 AUG 12-1300	Croydon base on this day for 85 Sqdn (Hurricane)	II/KG 3 escorted by Bf 109 of JG 26 and Bf 110 from Erpr Gr 210	DO 17		The Dorniers penetrated at 2000 feet and were over the airfield as 85 Sqdn scrambled.
31 AUG 12-1300	Biggin Hill and Horn- church Sqdns 72 and 79 were already airborne from Biggin Hill 54 Sqdn was forced to scramble from Horn- church under attack	KG 2	HE 117 ? DO 17		Aircraft bombed from 12,000 feet hitting one of the two remaining hangars, messes and the Sector Operations room. Telephone communications were once again severed. The identification of units actually involved in these attacks is obscure. Battle over Britain states that Heinkels attacked Biggin Hill. The Luftwaffe War Diaries states both airfields were attacked by DO 17's of KG 2. The quartermaster returns of 31 August for the Luftwaffe suggest that the aircraft intercepted and damaged after the raid was a Ju 88 of I/LG 1. Three Spitfires of 54 Sqdn were destroyed at Hornchurch as they attempted to get off. This series of attacks owed its success to the saturation of the radar net, the desire of controllers to hold squadrons at readiness and a heat haze which foiled visual observation by the Ground Observer Corps.
31 AUG after-	Beachy Head CHL, Whit- stable, Foreness CHL, Rye CH, Dunkirk CH, and Pevensey CH	ErprGr 210	Bf 110		All sites were damaged, but all were active again by the end of the day.
31 AUG 1730	Hornchurch and Biggin Hill	ErprGr 210	Bf 110 + 1 Staffel of uniden- tified		About 30 bombs were dropped on each location. Two Spitfires were destroyed at Hornchurch but both assigned squadrons had already been scrambled when the raiders arrived.
					On the 31st of August a total of more than 1300 fighter (Bf 109 and Bf 110) sorties had been expended to support 150 bomber sorties against 11 Group's airfields. The German approach was once again to force Fighter Command to engage in air-to-air combat by threatening the base structure. After this day 72 Sqdn was transferred to Croydon because of the widespread damage at Biggin Hill while 79 Sqdn remained for airbase defense.

DATE	TARGET	ATTACKING UNIT	NUMBER + TYPE	ORDNANCE	RESULTS/REMARKS
1 SEP 1100	Biggin Hill, with 79 Sqn, Detling, Fleet Air Arm station and East- church Bomber Command base		30 bombers escorted by about 30 fighters		Number 79 Sqdn was not in a readiness state and remained on the ground. Number 610 Sqdn was in preparation to transfer to the north. At least one Hurricane was destroyed.
1 SEP 1300	Biggin Hill, Lympne forward airfield				Lympne was attacked while servicing aircraft.
1 SEP	Airfields including Biggin Hill				The last attack during daylight was primarily a large fighter sweep which was unopposed by 11 Group. These aircraft strafed airfields while a small group of DO 17's penetrated under cover of the fighter sweep and bombed Biggin Hill for the third time of the day. Communications were again cut and a direct hit was suffered on the sector operations center. By the end of this day six out of seven sector airfields were badly damaged along with five forward airfields. On this day Ober Kommando der Luftwaffe (OKL) issued orders to commence attacks against the British aircraft industry. The battle of the airfields had reached its zenith.
2 SEP 0700	Biggin Hill, Rochford, Eastchurch, North Weald	KG 3 JG 51 in escort	20 + DO 17 Bf. 109 in Geschwader strength		While fighters engaged the raiders at 13,000 feet, 9 more bombers attacked Biggin Hill from low level.
2 SEP 1700	Biggin Hill Kenley Hornchurch, Brooklands (site of a Hurricane factory and the Vickers works pro- ducing the Wellington bomber) Detling, Eastchurch	ZG 2 JG 53	250 + air- craft		The airfield at Detling was hit by more than 100 bombs with little damage caused. A bomb strike at Eastchurch detonated 350 bombs in the bomb dump destroying all buildings within 400 yards plus 5 aircraft. The raid on Brooklands partially fulfilled Fighter Command prophecy. Attacks against the production facilities had long been expected.
3 SEP 0900	North Weald	KG 2 escort by ZG 2	54 DO 17 escorted by	200 + HE bombs on the field, high proportion delayed action	Dorniers pattern bombed from 15,000 feet. All hangars were hit, two destroyed by fire, operations block was hit. The runway was cratered but remained open.

DATE	TARGET	ATTACKING UNIT	NUMBER + TYPE	ORDNANCE	RESULTS/REMARKS
4 SEP morning	Lympne and Eastchurch				Fighter sweep with strafing.
4 SEP mid day	Urban areas of Canterbury, Faversham, Reigate, airfield at Redhill and Eastchurch		70 + HE 111 DO 17 escorted by 200 + BF 109		This was apparently part of a complicated feint attack to cover a raid against the Hurricane assembly facility at Brooklands q.v.
	Brooklands Hawker factory	6/ZG76 and one Staffel III/ZG 76	Approx 20 bomb-carrying Bf 110 with a Staffel of Bf 110 in escort	6 500 Kg bombs on target	Although the briefed target was the Hawker works the attack was actually carried out against Vickers works at Brooklands. The six bombs caused more than 700 casualties (88 killed).
5 SEP					On this day Kesselring abandoned the pattern of tightly spaced and mutually supporting raids. Twenty-two separate raids were reported throughout the day. Biggin Hill and Hornchurch may have been targeted once again, but in both cases the attackers were intercepted and driven away.
6 SEP	Hawker Works, Brooklands				The phased attacks began again but airfields were not an obvious target. A small raid managed to penetrate to Brooklands and hit the Hawker works despite dedicated fighter patrols being mounted by 609 Sqn. The aircraft were being refueled on the ground when the raid developed. The damage to Hawker was slight.
					On this day Dowding announced the redesignation of all fighter squadrons to Class A, Class B, and Class C, and more important, the adoption of a policy which would result in experienced flying personnel from C squadrons being reassigned to A squadrons. The morale affect of breaking up squadrons which had been severely attrited in the battles and scattering their survivors was obvious. Fighter Command was hurt badly. Combat aircraft could be replaced but the crew training problem had begun to tell.

LESSONS FROM THE BATTLE

In the Battle of Britain, and the "Blitz" which followed, the Germans failed in both a struggle for air superiority and in an attempt at strategic warfare. In the most abstract sense, the strategists (probably primarily Hitler) failed to understand the intimate interrelationship between air superiority, air supremacy, and strategic victory. As the Combined Bomber Offensive against the Third Reich was to later suggest, these conditions follow each other and *must do so*. Hitler vacillated over objectives and all of his subordinates followed suit. Air superiority--the operational capability to carry out air operations of any type, at any location, at any time they are required--was the necessary first condition. This did not imply, and the Luftwaffe knew that it did not, that British airpower would totally cease to exist. It did imply that RAF Fighter Command, at least the combat power of Eleven Group, would have to be reduced (either through attrition or through lack of operational capacity to respond in a timely fashion) to the point that it could be overwhelmed at will.

Those responsible for implementing the strategy were faced with several related choices:

- Concentrate escorted bomber attacks against the individual sectors of Eleven Group until all airfields were sufficiently damaged that RAF aircraft would be withdrawn beyond the range of Luftwaffe fighter escort.
- Concentrate bomber attacks against "strategic" objectives in order to force fighter reaction and rely on air-to-air attrition to gradually reduce the fighter force.
- Attempt to "leverage" the offensive capabilities by destroying the home defense radar network.

The *Luftfotten* commanders, in fact, tried all of these approaches. One cannot say that German planners explicitly chose an incorrect strategy. In fact, they chose all strategies that were apparent given their understanding of the RAF and their own capabilities. The criticism rightly

lies in a failure to concentrate on any course of action and a failure to set forth some effective operational measures of success.

The choice of operational measures of success is a complex problem for all air forces in combat, and a problem which clearly exists even in modern day planning. The German approach finally boiled down to a reliance on pilot claims for air-to-air victories. It is clear in hindsight that this measure was worse than useless. Even though it combined with a German overestimate of RAF fighter strength, the multiple claims eventually convinced Kesselring that the air-to-air exchange ratio was sufficiently favorable that attacks on the airbase structure itself had no further utility. The established Luftwaffe doctrine called for attacks on airbases, but this doctrine was ignored for approaches that seemed to offer quicker and easier paths to a final victory. The attacks on metropolitan London were portrayed as offering a solution which would not require invasion. The management of an air campaign requires guideposts, and the Germans failed to develop them in the Battle of Britain.

OBSERVATIONS

- *The air planning for operations against Great Britain simply never jelled. Hitler's directive left open all the opportunity which an air commander could desire, but no plan was developed, either by Göring or his subordinates, which could make execution a reality.*
- *Planners continued to assume the capability to accomplish stated missions even when their own detailed studies told them that the required operational capabilities did not exist.*
- *Intelligence production failed to support Luftwaffe combat operations. Significant intelligence collection efforts against the air force targets were mounted only at the end of the Battle of France. Studie Blau was based on antiquated material, but formed the central theme of decision-making.*

- Luftwaffe SIGINT units provided significant tactical support, but the faulty conclusions reached in Studie Blau could never be overcome. German planners never accepted the possibility that the RAF was as flexible in operations as their own Sigint told them it was.
- Sigint concentrated on ground-to-air and air-to-air radio traffic of the fighter direction network as a completely separate problem from that of the intercept of radar emissions (what the Germans called Decimetric Telegraphy). This hampered evaluation of the anti-radar attacks.
- Relatively small mistakes in photographic interpretation caused major diversions of combat assets. Major raids were mounted on Naval air stations and bases of the RAF Coastal Command when these raids could have at best a secondary effect on the problem of destroying the British air defense system.
- While the Luftwaffe successfully mounted combined and coordinated operations within each of the Luftflotten, there was a conspicuous failure to coordinate the entire air war between the three Luftflotten in position to operate against the British Isles.
- The selection of targets, once battle was joined, was carried out at the Geschwader level. Coordination between the tactical units was intended to support arrangement of fighter support and rendezvous points, but rarely supported cooperative attacks.
- The Luftwaffe problem in support of SEA LION was a short-term one. Because of weather and tides the invasion had to take place early in the fall. There was no time to implement a long-term attrition strategy; the problem was to destroy forces-in-being. The final targets would have included Coastal Command and Bomber Command aircraft, but the initial target had to be Fighter Command.
- Kesselring and Sperrle believed the pilots' claims of air victories and assumed that RAF Fighter Command was being severely attrited. In fact, the exchange ratio was near unity and British airmen were surviving the engagements while German pilots were lost or captured.

- For the short-term support of SEA LION the Germans had to somehow increase the kill-per-sortie ratio. The use of the feint attacks to force RAF reaction and then attack freshly recovered aircraft on their bases showed an excellent tactical grasp, but the tactic was rarely used and soon degenerated into massive fighter sweeps which RAF Fighter Command ignored.
- The level of pressure which could be put upon Fighter Command was directly proportional to the level of German effort. Any cessation of attacks by the Luftwaffe translated directly in a period of rest for Fighter Command. Fighter Command's only mission was homeland air defense. Without the collateral missions of supporting ground forces the response could be sharply focused and the effectiveness of the Luftwaffe attacks minimized.

SECTION 4
OPERATION BODENPLATTE
JANUARY I, 1945

The Battle of Britain, despite its value as a source for historical lessons, was not the highwater mark in the Luftwaffe's quest for air superiority against Nazi Germany's enemies. That highwater mark was attained in the war in the east against Soviet Russia.

In the initial attacks on 22 June 1941, the Luftwaffe brought sixty-five percent of all available Soviet air forces under direct attack, and even by Soviet reckoning secured air superiority over some axes of the Soviet-German front.¹ The initial success was unexpected by the Germans, a fact which was reflected in the wording of the OKH² deployment directive which stated that since it was unlikely that complete air superiority could be won, field commanders should expect greater interference from the enemy air force than in previous campaigns.³

The value of this initial success was temporary at best, however. The assumption that the ground forces could quickly capture a sufficient portion of the western Soviet Union to allow the short ranged Luftwaffe to bring the Soviet industrial base beyond the Urals under attack proved false. The story of the Luftwaffe's failure to carry through with the design of a "*Uralbomber*" after General Wever's death is well known to students of Luftwaffe history.⁴

The story of the war in the east is perhaps best told from the Soviet perspective, and the war in the west against the Luftwaffe is, in essence, the story of the Combined Bomber Offensive. But there is one final vignette about the war in the west which deserves consideration from the German side. The selection of Operation *BODENPLATTE* for inclusion in a study of airbase attack could be justified simply on the basis of the demonstration of planning techniques and the relatively massive commitment of forces, but *BODENPLATTE* also represents an additional "historical truth" concerning the struggle for air superiority in wars.

In Shakespeare's Macbeth, Banquo speaks of the planned assassination, "If it were done when 'tis done, then 'twere well it were done quickly... that but this blow might be the all and end-all here....⁵

This admonition may equally apply to large-scale air operations designed to seize air superiority - "be all and end-all attacks" must be done quickly. *BODENPLATTE* was the last gasp of the Luftwaffe fighter force, and, although the performance of the flight crews was almost faultless and temporary results of the operation were impressive, it essentially destroyed the German dayfighter force and its employment came too late to make any difference.

Operation *BODENPLATTE* (literally "Baseplate") is mentioned in many contemporary and modern secondary sources, but truly detailed studies of this operation are comparatively rare. The details quoted here are drawn mainly from Werner Gerbig's *Six Months to Oblivion*,⁶ and from issues of *Impact*, the formerly classified publication of the Assistant Chief of Air Staff, Intelligence.⁷

PLANNING, FORCES, AND TARGETS

Operation *BODENPLATTE* was envisioned as the air component of the Ardennes Offensive and as such was under the direct control of Major General Peltz, commander of II Jagdkorps. The armored thrust through the Ardennes, however, had been specifically planned to take advantage of bad flying conditions so the aerial portion of the attack was disconnected in time from the ground offensive. *BODENPLATTE* was planned for execution on New Year's Day of 1945. Many brief accounts of the operation have assumed that the date was chosen to exploit the aftereffects of the traditional New Year's celebration, but Gerbig maintains that the selection was driven entirely by weather conditions.

Aircraft from more than twenty-three separate Gruppen were involved in the operation, and about 875 aircraft were committed. The formations, of Gruppe strength, were composed primarily of dayfighters led by pathfinders drawn from nightfighter Geschwadern. A cardinal precept of the attack was

total radio silence, both outbound to the targets and on the return to base as well. The Luftwaffe planners, by this stage of the war, were fully cognizant of the Allies' successes in the field of tactical signals intelligence and sensitive to the need for surprise on this massive attack. The requirement to perform the entire mission without either air-to-air or air-to-ground radio communications, however, forced the formations to rely on pre-coordinated free passage zones through the Reich's rather formidable air defenses.

The target set for the attack was a broad array of forward bases of the Ninth Tactical Air Force (US) and the Second Tactical Air Force. Initial planning allotted the following targets:

- (1) Belgium
 - (a) St. Denis Westrem
 - (b) Brussels-Evere
 - (c) Brussels-Grimbergen
 - (d) Brussels-Melsbroek
 - (e) Antwerp-Durne
 - (f) St. Trond
 - (g) Le Culot
 - (h) Asch
- (2) Holland
 - (a) Eindhoven, and
 - (b) Volkel
- (3) France:
Metz-Frescaty⁸.

At least three of the primary targets in the actual attack were either missed entirely or attacked unsuccessfully while as many as ten unbriefed targets were brought under attacks of various degrees.

BODENPLATTE is a story of the dice all coming up snake eyes. The reports on allied losses vary wildly from 127 destroyed and 133 damaged⁹ to 279 destroyed reported by German photoreconnaissance to a Luftwaffe High Command report of 467 destroyed.¹⁰ The allied losses were substantial but Gerbig suggests that the destroyed aircraft were fully replaced within two

weeks. The story was different for the Luftwaffe. Losses amounted to something on the order of 300-400 fighters, but most important, Gerbig shows a loss of 232 pilots killed, missing, or captured. This total included:

- (1) 3 *Geschwader* commanders,
- (2) 6 *Gruppe* commanders, and
- (3) 10 *Staffel* leaders.

Losses of aircraft and crews approached thirty percent across the entire operation.¹¹

A successful attack of this magnitude during the early days of the Battle of Britain might have effectively destroyed the RAF Fighter Command, but by this point in the war it succeeded only in destroying the German dayfighter force.

ATTACK EXECUTION

Gerbig's book details the mission from the viewpoint of twelve separate *Geschwadern*. The evidence is a useful checklist for determining almost every type of ill fortune which can befall an operation.

The extreme emphasis on communications security resulted in an order that the FuG 25 IFF set should be physically removed from each aircraft involved in the operation.¹² Further, it rapidly became clear that coordination with the Luftwaffe's own *Flaktruppen* had not been successfully accomplished.

I *Gruppe* of *Jagdgeschwader* 1 flying from the airfield at Twenthe had laid out an attack route to Maldegem airfield which promised an easy run -- it was over friendly territory all the way to the coast then over the North Sea to a landfall near Bruges. (See Figure 3). German gunners, however, reasoning that a grouping amounting to more than fifty fighters at low level in the coastal area could only be an enemy group, opened fire. I and III *Gruppen* missed their target at Maldegem and accidentally joined another formation en route to St. Denis-Westrem. II *Gruppe*, en route to attack St.

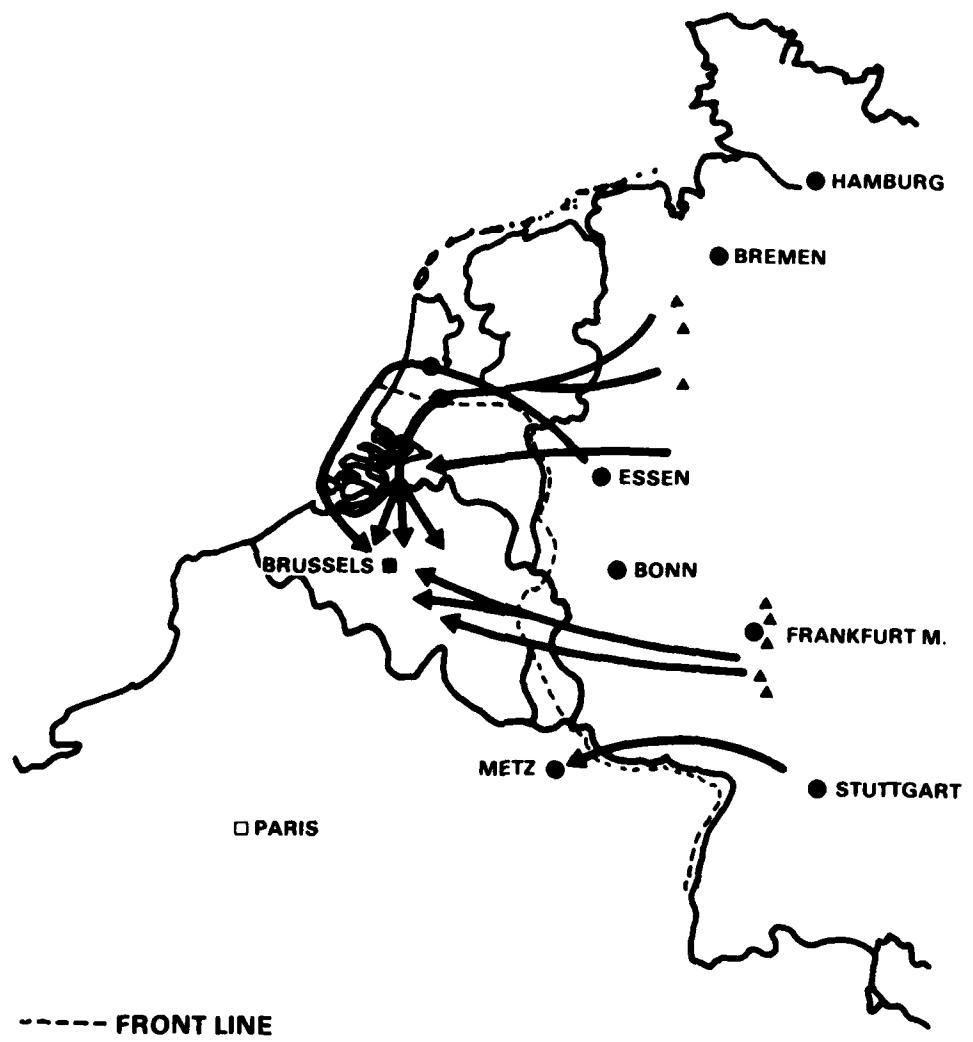


Figure 3. Operation BODENPLATTE, January 1945.

Denis as its mission was set upon by two Polish Spitfire squadrons of the RAF which had been alerted by the earlier accidental attack.

A large formation consisting mainly of JG2, (the Richtofen *Geschwader*) and the Fourth Close Support *Geschwader* came out of the High Eifel to attack the former German base at St. Trond, now holding the 48th and 404th Fighter Groups of the Ninth US Tactical Air Force. This formation was taken under heavy antiaircraft fire soon after crossing the line at Aachen and flew straight into alerted defenses at St. Trond. The airfield defenses, in response to the clearly recognized threat posed by the V-1 flying bomb, were truly dense. The combined JG2 and SG4 formation suffered losses amounting to more than forty percent in this single attack.

Navigational errors by the pathfinders and poor visibility in the snow-covered target areas caused the attacks on Le Culot and Volkel to fail.

I *Gruppe, Jagdgeschwader 26 (Schlageter Geschwader)* had more of the same incredible bad luck. German flak claimed one *Staffel* leader on the outbound leg to the target at Brussels-Grimbergen. Over the North Sea, in the one portion of the mission which should have been a "milk-run," JG26 strayed across the path of a British warship and took at least two more losses. The crowning blow, however, was that when the formation of fifty-odd fighters arrived at Grimbergen it was *empty* except for a scattering of multi-engine aircraft and a single Mustang. II and III *Gruppen* of JG 26 found better hunting at Evere airfield and claimed some 120 aircraft destroyed on the ground.

All three *Gruppen* of JG77 were committed to an attack on Antwerp-Durne. In an unusual situation for 1945, this *Geschwader* was near full strength with 100 fighter aircraft -- and, further, on New Year's Day, the units were at 100 percent O.R. The plan for JG77 called for a long end-run of 200 miles to allow an approach from directly north of Antwerp. This group was fired on by German naval flak near Rotterdam.

Upon arrival in the Antwerp area several aircraft mistakenly attacked a British airfield at Wonsdrecht. The five Spitfire squadrons normally based on this field were already airborne. The mistake caused further

problems in timing and attack phasing, and no more than thirty German aircraft ever appeared over Antwerp-Durne.

The crudest commentary on the effect of this operation may be found in the action reports which cover the period immediately following the attack. On the very day of the operation one of the participant recalls, "After the operation was over I landed back at Twenthe with I Gruppe, 1 Jagdgeschwader and the enemy air activity was so intense I couldn't fly on to Delmenhorst till the evening."¹³

The action report of Fourth Fighter Group of the Eighth Air Force similarly suggests business as usual for the bombardment of the Third Reich.

1 January 1945: F.O. 1476A. On a Penetration Target Withdrawal Support to Derben-Stendal-Genthin, Germany, Maj. Glover led A Group from 0925 to 1440 hours and Maj. McKennon led B Group from 0930 to 1445 hours. A rendezvoused with B-17s northeast of Heligoland at 1125, flying at 25,000 feet. After the leader sent two flights to stay with the bombers, 336 made a bounce at 1230 in the Ulzen area, downing four Bf 109s. Donald Pierini, after getting one of these 109s, shot down an Me 262. Escort was broken at 1330 west of the Rhine at 22,000. B Group made landfall near Sylt, following the bomber track, but the P-51s never caught up. They went to the target area and then came back out over Walcheren at 1402, 25 minutes early.

(Box Score: 5 destroyed, 0 lost)¹⁴

While Operation *BODENPLATTE* failed to affect the strategic air war it equally failed at the tactical end. *BODENPLATTE* might have stymied allied operations against German armored forces withdrawing from the "Bulge," but even in that it was not successful. In the week of 22-29 January, the Ninth Air Force reported huge enemy losses in ground equipment:

<u>Types</u>	<u>Damaged and Destroyed</u>
Motor Vehicles	8,185
Armored Vehicles and Tanks	460
Railroad Cars	2,817
Locomotives	53

The report in *Impact* concludes; "This is a staggering total of 11,569 pieces of heavy equipment, enough to give German logisticians nervous breakdowns. Small wonder POWs report that their greatest fear is the "Jabo," abbreviated German for fighter-bomber."¹⁵

LESSONS FROM THE BATTLE

BODENPLATTE was simply too late; its operational goal was either undefined or unachievable. Under the effects of the continued Allied offensive against the Luftwaffe fighter force, the costly losses in trained air crew could never be overcome. Once air superiority over the homeland was lost the price to regain it was simply too high.

OBSERVATIONS

- A significant part in the failure of *BODENPLATTE* can be traced to a misplaced concern with security. Security was paramount but the failure to coordinate free passage through the forward flak defenses cost more than it could have saved.
- In cases where free passage had been arranged some flights were fired upon because their take off was delayed by ground fog. There was no abort function built into the plan.
- The German understanding of the value and impact of tactical Sigint was very clear in this operation. Despite the failure to properly coordinate with air defense, several flights did achieve tactical surprise.

SECTION 5

THE SOVIET EXPERIENCE

At the outset it is important to understand that Soviet military historiography often differs substantially from its Western counterparts. While there are relatively "pure" historical accounts of past events represented by official histories, there is also a very large superstructure of "popular" military history. This popular literature is epitomized by articles, based upon the history of the Soviet participation in World War II, which are couched in terms of "What lessons should be taken from combat?"

These modern accounts of historical battles are quite often unabashed attempts to selectively use history to support preferred modern courses of action. It is characteristic of Soviet military historiography that no fact has ever been lost, and the central archives of the Ministry of Defense must be brimming over with files; but the facts are often marshalled forth in novel configurations to support whatever course the author might espouse.

The topic of airbase attack and counter air operations in general is one in which the selective reworking of history is presently rather apparent. The customary Soviet approach to the allied bomber offensive against the Luftwaffe has been to hold that OPERATION POINTBLANK and the bomber offensive against the German synthetic fuel industry were ill planned and ineffective. A 1980 article in the Military Historical Journal expressed the common doctrinaire view:

..., the Anglo-American command did not wish to conduct a vigorous struggle to undermine the enemy's air might. They did not take full advantage of the enemy's weaknesses. As a result, the struggle for air supremacy in the West European TVD bore a "languid" character and was crowned with success only at the war's end. The combat effectiveness of the German Luftwaffe was undermined not so much by the strikes of Anglo-American aviation against enterprises of the aviation industry and aviation fuel plants as by the destruction of air groupings at the Soviet-German front.¹

At the same time it is clear that at present a major reorganization is underway in the Soviet Air Forces. The justification of this reorganization and the development of advocacy positions for theater-dedicated bomber forces require Soviet military commentators to make strong cases for the utility of deep penetration. As Colonel-General of Aviation Dagayev commented in a major article on reorganization, "As a whole, the improvement in the organizational forms of long-range bomber aviation can be characterized by an overall trend to *create an independent strong air grouping for operations against the objectives in the operational and strategic rear of the enemy*" [emphasis added].²

The dual desires, to both denigrate Allied efforts in history and at the same time to justify forces in modern times for what the Soviets call "strategic" operations--operations to the full depth of a theater of military operations--results in a kind of schizophrenia in the current military-historical literature. Much of the military-historical literature of the late 1970's reflects the latter desire--a search for historical justification of "strategic" air forces.

It is clear, based on an overview of Soviet literature, that Soviet counter air campaigns were carried out during the war, but equally clear that their character, planning, scope and duration never approached the Combined Bomber Offensive in either dedication or effect. A study of Soviet airbase attack campaigns, then, has relatively little of value to bring to the modern planner in terms of goals and techniques. What is much more important and valuable is the recognition that modern Soviet commentators are seriously attempting to reportray historical fact in such a fashion that a doctrinal base for a long range independent air force is created. One of the primary functions ascribed to the independent air force is seizure and maintenance of air superiority. The general tenor of current Soviet commentary suggests that their interest in airbase attack has undergone a decided increase.

COMBAT DOCTRINE

It is interesting to consider prewar Soviet aviation doctrine and organization as a basis for understanding the direct and devastating impact of the initial German counter air operations which supported Barbarossa, the German invasion of the Soviet Union on 22 June, 1941.

At the opening of the war, Soviet aviation forces were organized into:

- Aviation of the High Command (long-range bomber aviation),
- Frontal Aviation (the air forces of the military districts),
- Army Aviation (the air force of the combined-arms armies), and
- Troop Aviation (the corps' aviation squadrons).³

The relative weight of these aviation forces was:

- Aviation of the High Command - 13.5 percent,
- Aviation of the ground forces - 86.5 percent,
- The breakdown of the latter was Frontal Aviation - 40.5 percent,
- Army Aviation - 43.7 percent, and
- Troop Aviation - 2.3 percent.⁴

The operational doctrine of the late 1930's assigned a premier place to the seizure of air superiority, and assigned the main thrust of that mission to the Aviation of the High Command. Soviet authors stress that their doctrine differed from that of the "imperialist" powers in several significant ways; the writings of Douhet, for instance, are singled out for criticism as being based on "idealism and metaphysics."⁵ After a rather involved discussion of Douhet, in which his advocacy for independent air forces and "concentration of forces in the air"⁶ was totally rejected by the preponderantly ground-oriented Red Army, the key doctrinal judgments concerning the seizure of air superiority which were adopted actually appear to vary only slightly from those of the West. "Our military art stated that the struggle for air superiority had to be directed above all at the destruction of the aviation striking force of the enemy."⁷

The discussions of optimum methods of operation in support of air superiority had ranged across the broad spectrum of mission and target requirements.

For the delivery of strikes against airfields, aviation depots, bases, maintenance - repair shops, it was recommended to rely upon light bomber aviation. Destruction of enemy aviation at great depths, destruction of major bases, training centers, disruption and destruction of targets of the aviation industry would be entrusted to long-range bomber aviation.⁸

Despite the continuing discussion and despite the vicarious experience of watching the Battle of Britain unfold, the Soviet approach was described in December of 1940 by Chief of the Main Staff of the VVS, P.V. Rychagov, as follows:

... the seizure of superiority in the air would be achieved through destruction of enemy aviation on airbases with simultaneous strikes to the enemy's depth (front bases, maintenance organizations, stockpiles of fuel and ammunition), and also destruction of enemy aviation in the air over the battlefield.⁹

Rychagov had captured the essence of what came to be known as the "air operation," a special employment of air power which could justify an independent role, albeit for a brief period of time. Timokhovich points out, however, that severe planning shortfalls still existed.

Together with this it should be mentioned that not all questions on the seizure of air superiority were deeply and completely researched. For example, there was no detailed analysis on questions of the organization and conduct of air operations for the destruction of enemy aviation or on the achievement of surprise in attacks against enemy aviation.¹⁰

The putative weakness in the development of operational art was not repeated in the fields of aviation construction and reinforcement. From 1930 to 1939, the operational strength of Soviet air forces increased by 6.5 times. The production of combat aircraft increased from 860 in 1930/1931 to 8331 in 1940. In 1940 alone, more than 10,000 aviation specialists of various types were produced by Soviet military schools.¹¹

Further, the buildup in the forward military districts was well underway (see Figure 4). As an example of the strength of these

Military District	Divisions				*Regiments				Total Corps' Avn Sqdns
	Bomber	Fighter	Composite	Total	Bomber	Fighter	Gnd Attack	Recce	
Leningrad	1	3	4	8	9/1	13/4	1	1	24/5
Baltic Special	-	1	4	5	8/1	8/3	2/1	1	19/5
Western Special	2	1	3	6	13/2	12/5	2/1	2	29/8
Kiev Special	3	2	5	10	11/4	17/5	2/1	2	32/10
Odessa	-	-	3	3	-	7/4	-	1	15/6

*Regimental numbers are given with the total value followed by the number of regiments of that total which were equipped with new-type aircraft.

- Notes:
1. Two of the 3 divisions in the Leningrad district were PVO fighter divisions.
 2. Two more fighter divisions and one bomber division were being formed in the Western Special military district.
 3. Two fighter divisions were being formed in the Odessa military district.

Figure 4. Strength of the VVS in the Western Military District on 22 June 1941¹³.

formations, in the Western Special Military District the air force of the military district plus the third aviation corps of the long-range bomber aviation of the High Command totalled 1825 combat aircraft of which around 60 percent, or 1,086 aircraft, were combat ready.¹²

THE CATACLYSM, 22 JUNE 1941

At this point the Luftwaffe reached its epitome of success in the massive initial strike against an opponent's air power. According to Soviet sources, 1,136 combat aircraft were destroyed--some 800 of them on the ground--in this single day.¹⁴ German sources hold that 1,811 aircraft were destroyed for a loss of thirty-five Luftwaffe aircraft; of the 1,811, 1,489 were said to be destroyed on airfields.¹⁵ It is not important now what the precise numbers were. The key point is that the single day's attack crippled the Soviet air forces, and forced a redirection of the long range bomber force. General Dagayev states:

With the start of the war [long-range aviation] had to be used for carrying out missions in the interests of the front, since the frontal aviation had suffered high losses in the very first days of the war During the entire war, the situation on the fronts required the use of shock aviation in operational and tactical cooperation with the ground forces. For this reason, the Soviet command was forced as before to concentrate the efforts of long range aviation on supporting the ground forces. Over forty percent of all the sorties of the long-range bombers were carried out for this purpose. They began to be used basically at night As a whole, the operations of long-range bomber aviation in the deep rear were not widely employed, and comprised a little more than three percent of the total number of its aircraft sorties.¹⁶

There is clear evidence of system advocacy in Dagayev's summing up of the experience of the war, "But the predominant use of the long-range bomber aviation as an operational-tactical and not a strategic means was an *inforced measure and in no way meant a revision of former views*" [emphasis added].

The wholesale destruction of combat aircraft and the intense pressure along the Soviet-German front forced the efforts to seize air superiority into an "episodic mode" which emphasized offensive fighter sweeps and air-to-air battles over preplanned massive operations against airfields. General Timokhovich explains the situation as follows:

During World War II the proportion of strikes against airfields dropped. Air battles and engagements acquired the deciding role in the struggle for air supremacy. This was the result of a number of factors. *First* of all, by the dispersal of aircraft, an increase in vigilance and combat readiness of the air force, a reinforcement of airfield air defense, and an improvement in the VNOS system, which made it difficult to achieve surprise and reduced the effectiveness of operations against basing areas of aircraft. *Secondly*, by the difficulty of organizing strikes against airfields. To ensure their high effectiveness, it was necessary to carry out a large complex of preparatory activities (thorough reconnaissance and final reconnaissance of airfields, organization of close coordination among groups of aircraft, suppression of air defense weapons along the route and in the target area, and so on), for which there was not always enough time, forces or weapons. But the slightest omission of any of these matters meant that combat operations against airfields proved ineffective and were accompanied by heavy losses of friendly aircraft. *Thirdly*, by the need to use major forces of aircraft for supporting ground forces and naval forces in operations. For example, Soviet aviation used a little more than two percent of the sorties flown during the Great Patriotic War to destroy enemy air forces on airfields. But this did not at all mean that this method of the struggle for air supremacy was ineffective and had lost its importance. To the contrary, during airfield strikes Soviet pilots knocked out 13,000 enemy aircraft, which comprised some 23 percent of the total number of enemy aircraft destroyed at the Soviet-German front. An average of five sorties were spent for each enemy aircraft disabled on the ground, i.e., 5-6 times less than in air battles. In addition, during the strikes against airfields a portion of the flight and technical personnel was injured, runways often were demolished, fuel and ammunition dumps and stores of aviation-technical equipment near airfields were destroyed and aircraft control points would be disabled.¹⁷

AN INDEPENDENT ROLE FOR THE VVS: THE AIR OPERATION

Prewar Soviet doctrine under pressure from the ground-oriented leaders of the Red Army had rejected the independence of air power. Even in the description of the role of the air forces of the High Command it was noted that mechanized forces, cavalry formations, and parachute assault forces would play an important role in the seizure of air superiority.¹⁸ In the course of the war several developments which centered upon an independent role for aviation forces were undertaken. Because of the nearly insatiable requirements of the Red Army for air support this centralized control and employment of air forces was forced into periods when major ground offensives were not underway.

If the situation required it, airfield strikes at times played a predominant role in the destruction of enemy aircraft. This was observed most often during periods of operational and strategic pauses and prior to preparations for major strategic operations, when aviation forces were at a low level of activity in accomplishing missions of supporting ground forces and naval forces.¹⁹

The combat situation facing planners of the Summer-Autumn campaign of 1943 put a high premium on dual goals - the rapid seizure of strategic air superiority and disruption of the concentration of enemy forces on the Kursk axis. The activity of the VVS was envisioned as a massive, centrally controlled air operation carried out as a surprise attack on German airfields on a 1200 kilometer-wide front from Smolensk to the Sea of Azov. This operation was to combine the combat actions of six air armies on the basis of a single integrated plan developed by the General Staff.²⁰ All primary airfields of the enemy were to be attacked by groups strong enough to overwhelm the airfield defenses and follow-on strikes were to continue on the basis of reconnaissance carried out both day and night. The fact that German aircraft operated primarily from austere airfields and grass strips, and the lack of a significant Soviet capacity to employ heavy

bombers in saturation raids against the fixed facilities, led to a high concentration on tactical schemes which would catch aircraft on the ground. The key target was not airbases but airplanes.

On the first day of the operation 434 Soviet aircraft attacked 17 German airfields in the course of 30 minutes. The initial attack achieved surprise and destroyed 194 enemy aircraft on the ground with a further twenty-one shot down in aerial engagements. Soviet losses amounted to twenty-one aircraft.

On the afternoon of the following day (6 May) 372 aircraft attacked 20 German airfields now fully alerted and reinforced by the 88 millimeter Flak units. In the second attack, 134 aircraft were destroyed on the ground, 24 in aerial battles, against forty-six Soviet losses.

In three days the committed air armies delivered 1,392 sorties against the enemy airfields and destroyed 373 aircraft on the ground. Total destroyed and damaged German aircraft amounted to 501 in the three day operation with total Soviet losses amounting to 122 from all causes.

The loss of surprise in the subsequent attacks had an obvious effect on the effectiveness of attacks. In the first massive attack the expenditure of sorties per destroyed aircraft was 2.0; for the second 2.4; for the third 3.2; and for the fourth attack 30.2 sorties per aircraft destroyed. Soviet losses matched the decline in effectiveness. In the first attack losses equated to one per 21.7 sorties; in the second one loss per 8.1 sorties; and in the third, one loss per 8.4 sorties. No Soviet losses are given for the fourth attack but it is described as "completely ineffective."²¹

Again from 8-10 June 1943, the Soviets mounted a massive counter air offensive, this time with three frontal aviation air armies supported by units of long-range aviation. The goal of this operation was concentration against enemy bomber forces discovered by reconnaissance. The scope of the operation was narrower than the previous operation and the enemy was not only fully alerted but was actively carrying out his own campaign against Soviet airfields. The weight of the effort was directed at fifteen, and then at thirteen primary airfields. This operation was a brute force

approach with a great weight of effort on suppression of the newly strengthened airfield defenses. Single airfields were attacked by formations of 160 aircraft--half of which were fighters with the mission to suppress defenses and cover the attack aircraft from enemy fighters. Separate fighter operations were directed to "blockading" German fighter fields on the approach routes. In three days the Soviets destroyed 168 enemy aircraft on the ground and shot down another 81.

The Soviet attacks were supported by intensive cover and deception activities at their own operating locations. In the operations area of the Southern Front, for example, German attackers, over the period of one and a half months, dropped 2,214 bombs weighing some fifty tons on false airfields while only 61 bombs amounting to 3 tons were dropped on real operational airfields.²²

THE DEVELOPMENT OF TACTICS FOR AIRBASE ATTACK

A further topic which has been resurrected for discussion in the modern Soviet press is the employment of "stratagems" or tactical deception to enhance the impact of attacks against airbases. Most of the strategems discussed involve the employment of feint attacks designed to provoke an expected reaction by the enemy or the exploitation of repetitious enemy approaches to operational problems. The value of feint attacks was set forth in a directive of the Commander of the Red Army Air Force on June 29, 1943:

In order to guarantee the greatest surprise for our ground attack aircraft (*Shturmoviki*) and bombers, it is advisable to send out a strong force of fighters with a small group of *shturmoviki* one hour or one hour and ten minutes beforehand. The *shturmoviki* should simulate an attack on the airfield while the fighters should attack the enemy fighters or at least force them to use up fuel and land at the airfields at the very time that our *shturmoviki* and bombers will appear over the target with a strong fighter cover.²³

In a modern context feint attacks were described as follows:

By military cunning one understands the ability to deceive the enemy, to confuse him about one's true intentions and force the enemy to take a wrong decision. Successful cunning in air combat was always considered an indicator of high tactical skill of a fighter pilot. In order to incline the enemy to take an incorrect decision, feints were widely used under combat conditions. By calling attention to themselves or by creating a threat in a spurious sector, the feint group ensured a surprise attack for the strike group which was concealed until the moment of entering combat.²⁴

A second approach is to rely on observation of the enemy activities and upon calculation of mission timing to provide an opportunity to attack aircraft in the landing pattern. Colonel Tomilin uses the example of a 27 February 1944 raid against German forces at Idritsa:

The air situation. On 26 February 1944, air reconnaissance had photographed the Idritsa airfield and spotted up to 90 Nazi aircraft, including up to 65 JU-87 bombers. The airfield was covered by forces of up to 11 antiaircraft artillery batteries which cooperated with the antiaircraft artillery at the railroad station, and up to 8 batteries for the city of Idritsa. From 1000 hours on 27 February 1944, the enemy, taking off in groups of 18-24 JU-87, began bombing the battle formations of our troops.

The plan. For winning air supremacy during the period of the concentrating of our troops and their going over to the offensive, the commander of the 15th Air Army decided: on 27 February 1944, in two waves, to attack the Idritsa airfield with the mission of destroying the enemy aircraft.

- a) The first wave of six Il-2, immediate escort twelve Yak-9. Raid to be made by surprise.
- b) Second wave of twelve Il-2, direct escort of ten Yak-7 and twelve La-5 for sealing off the airfield.

The strike was timed for when the enemy bombers were landing. It was to be hit with one pass with the complete expenditure of the battle load of ammunition.

Fighters: basic mission to combat the enemy fighters in the air, and in the absence of them to help neutralize antiaircraft fire and destroy aircraft on the airfield.

The bombload of the ground attack planes--85 percent small fragmentation bombs and the remaining 15 percent the FAB-50 and FAB-50 md demolition bombs.

Preparations for the operation. The Idritsa airfield was studied in detail by all flight personnel using large-scale maps and photographs. The flight personnel knew not only the quantity of equipment, but also the positioning of it on the airfield, and the number of antiaircraft batteries. They realized that the most intensive antiaircraft fire would come from the southern and southeastern sides of the airfield, while to the east of the airfield there ran a high forested hill which made it possible to escape from the antiaircraft fire in low-level flight.

Immediately before the flight, the personnel were given up to 2 hours of time for preparations (studying the last photographs, clarifying the questions of cooperation, and allocating the targets between the groups).

The strike against the airfield was made in two waves during the period of 1340-1400 hours. The routes were chosen far from roads and major population points across forested areas and lakes.

The first wave approached the target from the southwest in tree-top flight, and began the attack from an altitude of 70 meters, using the sun and the forest for concealment against the background of the terrain and for the surprise of the raid. The formation was a group of six in an extended front. The departure from the target area was over the forested hill.

The second wave made its run at the target from the north at an altitude of 1,200 meters after a sharp turn to the left with a loss of altitude and anti-AA maneuver, and began bombing from an altitude of 400 meters. The two groups of six ground-attack aircraft were in a right echelon.

Each of the crews independently chose its own target for bombing and firing, without losing its place in the overall combat formation. The antiaircraft fire was

neutralized by the assigned crews in the sector of the approach of the ground attack planes. The blockading fighters covered the ground attack aircraft, circling over the airfield at an altitude from 1,000 to 2,000 meters in three levels.

With the approach of the first group, the cover fighters engaged an enemy patrol (of six aircraft). The antiaircraft artillery was unable to open fire. The second wave was fired on from the ground and was attacked by a second group (of 8-10 aircraft) of enemy fighters approaching the airfield.

As a result of the strike on the airfield, 32 aircraft were destroyed and damaged, and six were shot down in air combat. Follow-up reconnaissance established 50 fires.

In the second half of the day, despite the improvement in the weather, not a single enemy bomber or scout appeared over our troops. The combat mission had been successfully carried out.²⁵

Tomilin, in his analysis of the example points out that,

...for the purpose of achieving high combat effectiveness, the time of the strike was not rigid, but rather was timed to the moment of the landing of enemy bombers at the airfield. This made it possible to catch the largest number of exposed targets on the ground. Moreover, the bombers which were landing or taxiing on the airfield impeded the takeoff of enemy fighters to repel the raid.²⁶

These examples clearly indicate an interest in tactical approaches which maximize the potential of an airbase attack and minimize the value of hardened aircraft shelters. It should be recognized, however, that in the forum represented by Tomilin's articles, what is being described is an advocacy position, not necessarily an accepted Soviet tactical concept. The potential for Soviet acceptance of some unconventional options exists. This potential, however, should be considered together with the accepted operational art of the VVS which appears to be somewhat conservative.

A reasonable portrayal of the mainline thinking which still appears to be prevalent in the Soviet Air Forces regarding airbase attack appears in a

set of rules promulgated by the Commander of the Second Air Army during World War II:

- "1. Strikes against airfields are successful only when they are backed up with reliable reconnaissance data and are carried out under conditions of surprise.
2. Repeated strikes against the same airfields, without updated reconnaissance data, upon personal intuition (that there should be aircraft at the airfields) and without careful preparations of the sortie, are absurd, and they lead to high, completely unjustified losses in equipment and personnel.
3. Strikes against airfields with small air groups are ineffective, they do not ensure the complete destruction of all the enemy equipment, but are more like individual handclaps used for the effect of frightening and not for complete destruction.
4. In raids against airfields, up to one-third of the forces must be assigned to neutralize the enemy antiaircraft positions for ensuring freedom of actions for the ground attack group. Neutralization can be achieved under the condition of good reconnaissance data about the target. There must be a bolder approach to the question of organizing in the air and combating of the ground antiaircraft defense system of the objective.
5. Experience has shown that the aircraft at an enemy airfield can be completely destroyed only by a massed attack on one of them. The order of forces for the strike should proceed from a figure of 1:1 (that is, there should be for every enemy aircraft one of one's own)."²⁷

Current writings suggest that a reorganization of some relatively vast scope is underway in the VVS and the turmoil of reorganization may represent fertile ground for modification to the existing operational art. What is important as regards the topic of airbase attack planning is that the Soviets are clearly using this mission area as a central theme in advocating force structure and mission changes. While the previous organization of frontal aviation clearly favored the missions which the Soviets call *aviatsionnoe prikritie* (literally "aviation cover" or defensive counter air) and *aviatsionnaya podderzhka* (aviation support), it is likely that the force which evolves from the present reorganization will have a strong leaning toward *offensive* counter air.

For US defense planners it may become imperative to address with renewed vigor the problems of suppressing and destroying air forces; it is clear that the present doctrines of both the US Army and the US Air Force assume air superiority.

LESSONS FROM THE BATTLE

Past Soviet historiographical approaches strongly emphasized the value of direct air support and questioned the value of airbase attack campaigns. Present Soviet concerns reflect a desire to justify an independent role for airpower. Discussions of reorganization show a strong predilection for the organizational form which existed prior to 1942. This form included dedicated and directly subordinated support for the ground forces (Army Aviation) and the existence of an independent grouping of airpower controlled from a higher command level (Aviation of the High Command).

During the war, the centrally controlled airpower was seen as a flexible source of combat air assets which could be used to shore up the air support to critical sectors. The Soviets referred to these formations as "*Udarnykh Aviationsionnykh Grupp*" - Shock Aviation Groups. These groupings were formed from aviation corps and independent aviation divisions of the Supreme High Command.

Modern discussions of combat operations have resurrected the value of airbase attack campaigns. The re-adoption of Army Aviation could potentially free Soviet fixed-wing forces from the requirement to support the ground forces as the first order of business, and could allow a greater diversion of effort to direct attacks against enemy airpower.

OBSERVATIONS

- Soviet attacks have emphasized both mass and surprise.
- Once surprise was lost the effectiveness of attacks declined precipitously but mass was substituted for the shock value of surprise.
- Soviet discussions concentrate on destruction of enemy aircraft. Disruption is portrayed primarily as a means to prevent enemy counteraction against planned attacks.
- Concentration upon strategems may only represent advocacy for less direct techniques of attacks, but in situations where NATO would plan large-scale defensive counter air operations, such "tricks" might provide high leverage for the attacker.
- Initial attacks where the Soviets expected to achieve tactical surprise might involve relatively small numbers of aircraft attacking each target in a large target set.
- Massed attacks against a relatively small number of high value airbase targets continues to be a Soviet approach under modern conditions.
- Previous discussions of attacks against the enemy's fixed airbase structure often centered upon the employment of rocket-delivered nuclear weapons. The modern discussions of airbase attacks concentrate upon the value of attacks delivered by aircraft presumably delivering conventional weapons.
- "Blockading attacks" designed to prevent enemy fighter reaction continues to be a concern, but destruction of aircraft through strategems or massed attacks appears to be a favored approach.
- Timely intelligence is a major concern in Soviet planning. Techniques which could prevent intelligence collection or could provide misleading information could severely hamper the effective execution of Soviet plans.

SECTION 6
AIRBASE ATTACKS IN SUPPORT
OF THE COMBINED BOMBER OFFENSIVE
(OPERATION POINTBLANK)

The history of Operation POINTBLANK is a contentious one. Both in its execution and in the subsequent analyses of the effect and effectiveness of this strategic bombing campaign, there are issues which have never been settled to the satisfaction of historians or to the actual planners and executors of the campaign.

The main sources of this contention are found in the diametrically opposed tactical choices made by the two partners of POINTBLANK, RAF Bomber Command opted for night operations and area attacks. While the partners had agreed upon the final form of POINTBLANK, the target selection directed by Arthur Harris, Commander of Bomber Command, slipped away from the commitments to the central plan and returned, in the late stages of the war, to a thinly disguised campaign of destruction against Germany's cities.

... October (1944), 6 percent of Harris's effort was directed against oil targets, less than in June. Between July and September 1944, 11 percent of Bomber Command's sorties were dispatched to oil plants, 20 percent to cities. Between October and December, 14 percent went to oil, 58 percent to the cities. It was impossible to believe that Harris was applying himself to the September directive. He had merely returned to the great area-bombing campaign precisely where he had left it in April, despite the almost unanimous conviction of the Air Staff that the policy had long been overtaken by events.¹

The US POINTBLANK planners had opted for daylight precision attacks against the war-supporting industries and economic infrastructure of the Third Reich. The effort was expended against:

- (1) Final assembly plants of the aircraft industry, especially fighter assembly plants;
- (2) Aero engine production facilities;

... it is improbable that a land invasion can be carried out against Germany proper within the next three years. If the air offensive is successful, a land offensive may not be necessary."⁴

The urge to embark on purely "strategic" operations, however, did not blind the planners to the criticality of their own counter air doctrine.

The plan acknowledged that the German air force, especially the German fighter force, would have to be defeated before an invasion could be contemplated, and that such a defeat might also be necessary to the prosecution of the air offensive itself. Hence defeat of the German Air Force was accorded first priority among air objectives--an "intermediate objective of overriding importance," to take precedence over the Primary Air Objectives themselves.⁵

The strategic role of POINTBLANK has received most of the attention by historians, both detractors and supporters. As an intermediate objective of overriding importance, however, direct attacks against the Luftwaffe form an important part of the story. POINTBLANK shows the effect of the adoption of both direct and indirect campaign strategies. Most of all, POINTBLANK is the story of a *plan* carried through combat execution.

THE PLANNING BACKGROUND FOR POINTBLANK

The roots of POINTBLANK from the US side are lodged in the previously mentioned AWPD-1 and its successor AWPD-42. These plans were not, in the strictest sense, combat plans. The intent of their development was as a guide for aircraft production.

AWPD-1

The story of the initial plan as related by General Hansell is a fascinating one. Given the opportunity to compile the air portion of the plan only at the last minute, the planners operated under a tremendous time

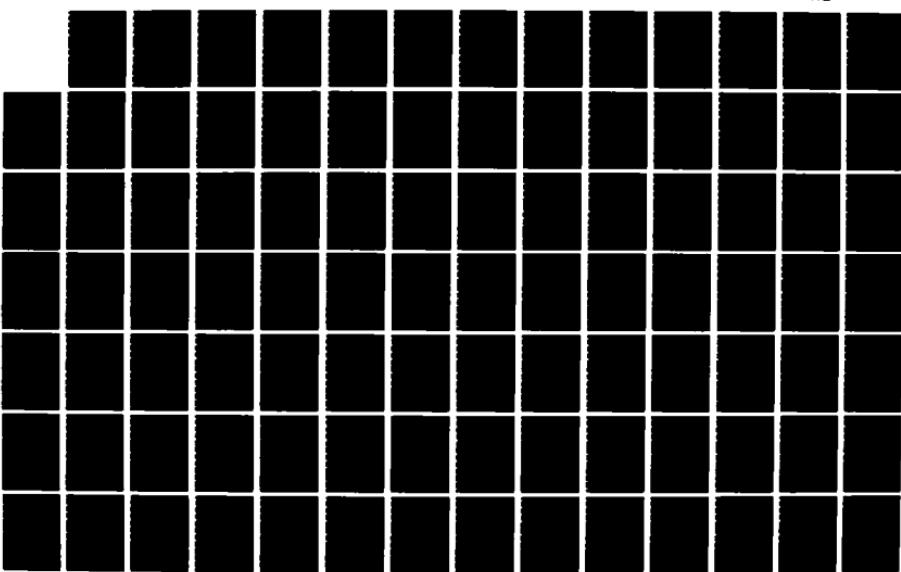
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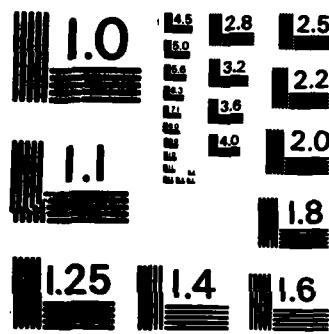
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- (3) The German ball bearing industry;
- (4) The Chemical industry, especially synthetic petroleum, synthetic rubber, and plants producing munitions;
- (5) Military transport vehicles;
- (6) General transportation in the civil sector; and
- (7) Submarine pens.²

In addition to these targets a significant amount of the total bombing effort had been expended on an emergency basis against the V-1 "Ski Sites" and fully thirty-seven percent supported the Army campaigns after the Normandy invasion.³

POINTBLANK was seen by its US progenitors as the operational extension of previous plans which envisioned true strategic air war. The direct goal of those planners was assurance of an independent military role for the US Army Air Force, and the eventual achievement of a totally independent status as a separate arm of the US armed forces. This overwhelming desire for independence did not necessarily hamper wartime planning, but it did put a great premium upon operations which could be portrayed as independent of the ground forces and "war winning" in their own right. General Haywood S. Hansell, Jr. has described the creation in the summer of 1941 of the first plan entitled AWPD-1:

In the Air Plan we described the overall objective
--the Air Mission--in these terms:

- "A. To wage a sustained air offensive against German military power, supplemented by air offensives against other regions under enemy control which contribute toward that power.
- B. To support a final offensive, if it becomes necessary to invade the continent. (Emphasis added)
- C. In addition to conduct effective air operations in connection with Hemisphere Defense and a strategic defensive in the Far East.

pressure. More weighty than even the pressure of time however, was the assumption by these men that the plan would have a direct impact upon their goal to design and field an air force independent of the Army. The mechanism employed was to fully describe the operations, targets, employment strategies, and force requirements for an air arm which would have responsibility for:

- (1) Air defense of the Western Hemisphere,
- (2) Prosecution of an unremitting air offensive against Germany and German-occupied territories,
- (3) The provision of strategic and close support air operations for a land invasion of Europe, and
- (4) Air defense and air support for strategic defensive operations elsewhere.⁶

The assumptions of AWPD-1 were broadly based upon the Joint War Plan known as RAINBOW-5 and upon the US-British discussions--ABC-1. In line with these conventions, the planners of AWPD-1 accepted that the forthcoming war would pit the US and Great Britain against Nazi Germany, Italy, and Japan. The assumption was that Italy would fall rapidly and that the US Fleet would fight a defensive action in the Pacific until victory over Germany could be assured. An interesting twist by these air planners was that task number three--air support to a continental invasion--was made conditional; it was to be provided *if an invasion proved to be necessary*. This suggestion that strategic bombardment alone could have brought victory against the Third Reich has been the center of argument since the end of the war. Whether an air offensive could have achieved final victory if "diversions from the plan" had not been permitted is impossible to answer. The value of these air plans, though, was not lodged solely in "strategic air war," and there has been virtually no question that the invasion of Europe was strongly supported by the destruction of the German Luftwaffe and the seizure of operational air superiority.

AWPD-42

In August 1942, a year after acceptance of AWPD-1, the creation of a second generation air plan was ordered. The world situation had changed to the extent that the United States was actively engaged in war, not merely contemplating one. The strength of the convictions held by the original planning team and their relatively clear prewar viewpoints shine through the second plan which varies only slightly from the original.

Again, AWPD-42 was not designed as a plan of combat operations. President Roosevelt had requested submission by General Arnold of a plan which would express "his judgement of the number of combat aircraft by types which should be produced for the Army and our Allies in this country in 1943 in order to have complete air ascendancy over the enemy."⁷ It is no longer clear exactly what was intended by the term "complete air ascendancy" but the planners of AWPD-42, like those of AWPD-1, did not limit themselves to matters purely related to air operations.

With a clear view of the strategic situation as it existed in the summer of 1942, AWPD-42 set the following tasks:

- (1) An air offensive against Europe to
 - (a) Deplete the German Air Force,
 - (b) Destroy the sources of German submarine construction, and
 - (c) Undermine the German war-making capacity.
- (2) Air support of a land offensive in Northwest Africa.
- (3) Air support of United Nations' land operations to retain the Middle East.
- (4) Air support of surface operations in the Japanese Theater to regain base areas for a final offensive against Japan proper; including:
 - (a) Land operations from India through China, reopening the Burma Road;
 - (b) Amphibious operations from the South and Southwest Pacific toward the Philippine Islands.
- (5) Hemisphere Defense, including anti-submarine patrol.⁸

The strategic situation had become manifestly more complicated over the comparatively simple view which had been put forth in RAINBOW-5 and AWPD-1. The US Joint Chiefs had inveighed against the North African Invasion (OPERATION TORCH), seeing it as an improper diversion of resources. General Marshall described it as a "tangential thrust at right angles to the proper axis of attack." As a result of discussion with the allies, however, the North African invasion was on. Despite RAINBOW-5's portrayal of the Pacific Theater as an area for a holding action, significant forces were beginning to be provided for that theater as well.

AWPD-42 was never accepted as a joint plan. The President's directive had explicitly separated the production requirements into those "which should be produced for the Army and our Allies."⁹ The planners recognized that this stricture did not allow for portrayal of a very real and substantial program of US Navy procurement of combat aircraft. In an attempt to balance the picture, the air planners included what they believed to be the latest US Navy program in the totals. One specific change, though, caused the plan's rejection. The land-based bombers proposed by the Navy were shown in the numbers and deployment areas prescribed, but they were shown as US Army Air Corps units. This change brought a severe reaction from the Navy and the plan was not accepted by the Joint Chiefs of Staff.¹⁰

AWPD-1 and AWPD-42 , though not designated expressly for the purpose, had provided important input to an overall strategic employment plan for airpower, the "intermediate objective with overriding priority" of which was the development of air superiority over Nazi-dominated Europe. These plans provided the most basic inputs to the development of operation POINTBLANK. Detractors have consistently argued that the "independent war-winning goals" of the Combined Bomber Offensive could never have been achieved; the plan's supporters have always pointed out the vast scale of diversions of effort. The intermediate goal of destroying the German Air Force was met however, *directly through adherence to the stated plan*, and it is this fact which has value to the modern planner.

THE COMBINED BOMBER OFFENSIVE - OPERATION POINTBLANK

The directive for the Combined Bomber Offensive from the United Kingdom was approved by the Combined Chiefs of Staff on 14 May 1943. By this point, General Arnold had been given five-star rank and sat as a full member of the Joint and Combined Chiefs of Staff, the US Army Air Corps was redesignated the US Army Air Force. The representative of US strategic airpower now held status equal to his British counterpart.¹¹ The influence of these airmen on the plan for the Combined Bomber Offensive is obvious. The text of the POINTBLANK plan is presented as Appendix D to this monograph. Some of its salient features bear mention here:

The Mission

The mission of the United States and British bomber forces, as prescribed by the Combined Chiefs of Staff at Casablanca, is as follows:

To conduct a joint United States-British air offensive to accomplish the progressive destruction and dislocation of the German military, industrial and economic system, and the undermining of the morale of the German people to a point where their capacity for armed resistance is fatally weakened. This is construed as meaning so weakened as to permit initiation of final combined operations on the Continent.¹²

The general goal for POINTBLANK exactly matched those stated in AWPD-1 and AWPD-42. Some target shifting took place (see Figure 1), but the intermediate objective remained the same:

Intermediate Objective

The Germans, recognizing the vulnerability of their vital industries, are rapidly increasing the strength of their fighter defenses. The German fighter strength in western Europe is being augmented. If the

growth of the German fighter strength is not arrested quickly, it may become literally impossible to carry out the destruction planned and thus to create the conditions necessary for ultimate decisive action by our combined forces on the Continent. (Emphasis in original)

Hence the successful prosecution of the air offensive against the principal objectives is dependent upon a prior (or simultaneous) offensive against the German fighter strength.

The German fighter force is taking a toll of our forces both by day and by night, not only in terms of combat losses, but more especially in terms of reduced tactical effectiveness. If the German fighters are materially increased in number it is quite conceivable that they could make our daylight bombing unprofitable, and perhaps our night bombing, too. On the other hand, if the German fighter force is partially neutralized our effectiveness will be vastly improved...

For this reason German fighter strength must be considered as an *Intermediate* objective second to none in priority.¹³

The POINTBLANK directive goes on to calculate in detail the forces needed to attack the chosen target structures. One final mention is made of the direct attack against airbases:

Medium Bombers

It will be noted that no United States medium bombardment aircraft have been specifically included in the computation of force required above. That does not mean that medium bombardment is not necessary to implement this plan. Supplementary attacks against all strategic targets within range of medium bombers are anticipated as necessary adjuncts to the heavy bomber attacks. In addition, medium bombardment is required in order to conduct repeated attacks against German fighter airdromes, to aid the passage of the heavy bombers until the attacks against the German aircraft industry make themselves felt. Medium bombardment will be necessary to support combined operations in early 1944. The crews must be operationally trained in this theater by that date.¹⁴

SELECTION OF TARGET

The relationship of AWPD-1, AWPD-42 and POINTBLANK is shown in Figure 5. It is noticeable that the size of the assessed target base declined throughout each subsequent generation.

The selection of targets was not perfect. The detailed postwar interrogations and memoirs of Albert Speer, Reichsminister for Armaments point out some clear deviations between the opinions of the Committee on Operations Analysis (COA) and the actual facts of the bombardment. As an example, electric power had held a high priority in AWPD-1. The priority of this target set was based both upon a substantial understanding of the German power network by the planners of AWPD-1 and by its attractiveness as a high leverage approach to the disruption of many German industries. This target set was lowered in AWPD-42 from second to fourth priority, but, in the target recommendations provided to the POINTBLANK planners, electrical power was dropped to thirteenth priority effectively eliminating it from consideration. General Hansell points out that the planners could have established virtually any priority they desired through specific target selection. Their reluctance to substantially modify the joint recommendation of US and British target analysts demonstrates the central position of the plan:

It would have been quite feasible--though difficult--to give electric power whatever priority we wanted. The Planning Team was reluctant, however, to challenge the intelligence structure which bore such wide and vital support. If the credibility of that intelligence base were seriously impaired the entire structure of the Air Offensive might be brought down. As a result, the Team made no effort to include the German electric power system in the CBO Plan. (Emphasis added)...

Electric power, in second place in AWPD-1 and fourth place in AWPD-42, was dropped in the Combined Bomber Offensive, and replaced by the German ball bearing industry. This was done because COA apparently considered the system to be beyond the capability of the forces that could be made available. We believed

AWPD-1	AWPD-42	POINTBLANK ¹⁵
Target Priorities	Target Priorities	Target Priorities
1. German Air Force Aircraft factories Aluminum plants Magnesium plants Engine factories	1. German Air Force Aircraft factories Aircraft engine plants Aluminum plants	1. German Air Force Fighter aircraft factories Aircraft engine plants Combat attrition
2. Electric Power Power plants Switching stations	2. Submarine Building Yards	2. Submarine Building Yards and Bases
3. Transportation Rail Water	3. Transportation Rail Water	3. Ball Bearings
4. Petroleum Refineries and	4. Electric Power Power plants	4. Petroleum Refineries and
5. Morale	5. Petroleum Refineries and synthetic plants	5. Rubber Synthetic plants
	6. Rubber Synthetic plants	6. Military transportation Armored vehicles factories Motor vehicles factories
Total targets 191	177	76
Programmed time of initiation: Mid 1943	Late 1943	Late 1943
Forces Planned: Bombers 3800	3000	3500

Figure 5. Comparison of plans.

this conclusion was a mistake but felt compelled to go along with it. We wondered if the COA had unearthed new information, unknown to us, which changed the importance or vulnerability of German electric power.¹⁶

Albert Speer manifestly did not agree with the assumptions put forth by the COA:

With all the other essentials, such as fuel or rubber or ball bearings, there was always a reserve stock, not to mention what was already in the pipeline to insure smooth distribution. Thus in all such cases we could have stretched our supplies for many months, even if production were halted. Electricity alone could not be stockpiled, and we need only remember the consequences of a blackout in New York City that lasted for just a few hours!¹⁷

AIRFIELD ATTACKS IN SUPPORT OF POINTBLANK

What was fixed and unchanging was the devotion of effort directly against the German fighter force on their airbases. Although the Combined Bomber Offensive is well known for its *indirect* focus on the German aircraft industry, the total statistics for bomber aircraft suggest a rather different focus even when fighter-bomber sorties are not considered. The aircraft industry was allotted a total of 5.1 percent of the total tonnage of bombs delivered during POINTBLANK. Airbases in France and Germany received some 10.7 percent of the heavy bomber effort or some 107,000 tons of bombs.¹⁸ In addition to the heavy bomber effort, the 9th, 12th and 1st Tactical Air Forces which had airfield targets as a high priority under the POINTBLANK guidance delivered another 458,000 tons of bombs.¹⁹ These raids were often planned as saturation attacks which were designed to knock *airfields* out of action whether or not they were occupied. The fighter-bomber attacks also contributed to destruction and disruption of the German air force efforts.

THE EFFECT OF CONTINUOUS AIR ATTACKS ON LUFTWAFFE OPERATIONS

One insight into the effects of the extreme pressure against Luftwaffe operations and ground support was provided by a witness to these operations from the German side. Karl Gundelach pointed out that German tactical doctrine held airbases in high regard as targets:

The organization of air forces within a theater of war consists of aircraft, airfields, and service personnel, each of which may become a lucrative target for an attack, depending on the prevailing circumstances. In this connection air bases are considered as really desirable targets because all elements of the enemy air forces are contained in them, such as aircraft, the airfields proper, and finally the personnel. Even though there is a possibility that attackers of an air base might find that the aircraft and also the personnel are absent, the destruction of these facilities in itself might be of decisive importance, if the loss of air bases induces the enemy "to abandon control over the air space of the theater of war."²⁰

The value of this manuscript is not its explanation of doctrine, but its insight into the operational effects of continuous attacks on the airfield structure of an air force. The comments are given extensively here since the distribution of the parent document is comparatively limited:

Some of the individual results produced by the Allied air attacks were as follows:

1. They destroyed the fortification of the Atlantic Wall as well as the launching groups of the V-1 missiles, thus channeling additional materiel and personnel to the damaged installations which in turn could not be employed for their original task--the improvement of the airbases.
2. By destroying the fixed launching ramps for the V-1s the Allied air attacks forced the Germans to use bomber units for the launching of the missiles, which were thus diverted from their assigned missions;

3. The strategic bombing attacks forced the Germans to retain radar equipment and antiaircraft artillery in the Reich, which could thus not be employed in Western Europe to protect the ground facilities of the Luftwaffe;
4. These air attacks also compelled the Germans to keep their fighter aircraft in the Reich so that the airfields in Western Europe were left without protection;
5. They smashed the principal airfields in Western Europe and thus forced the German units to shift to the secondary fields with their makeshift equipment, which often caused damages to the aircraft because of their defective condition;
6. By their air attacks, the Allies forced the Luftwaffe to evacuate its principal ground facilities to the east of France, thus forcing the German aircraft to execute long approach flights, which in turn had a decisive detrimental effect on the air support given to the ground forces engaged in the defensive battle around the beachheads;
7. The attacks destroyed the German aircraft on the ground;
8. They destroyed the technical service facilities, the supply depots, and the gasoline reserves that had been carefully preserved for the time of the invasion;
9. The Allied aircraft were ever present, and by constantly threatening the German Air Force around the clock they made the troops ill at ease;
10. Their constant pounding tortured and demoralized the forces;
11. They hit newly transferred aircraft and crews even before they arrived at their destination;
12. The attacks often resulted in inexperienced crews simply being unable to find their camouflaged airfields;
13. The attacks forced the German flying units to move without let-up from one alternate field to another;

14. These constant shifts caused additional losses of materiel and personnel along the overcrowded roads;
15. The air attacks forced the Germans to take one expedient after another, which were time-consuming and otherwise costly (camouflage, refueling at hidden parking areas, etc.);
16. The attacks forced the German units, and particularly their technicians and ground personnel to turn the night into day in order to accomplish operational readiness, thus compelling the Luftwaffe to "go underground;"
17. By exercising constant surveillance, the Allied aircraft prevented the Luftwaffe very often from taking off at the right time and then only permitted the piecemeal commitment of the forces available at the airfields;
18. By such actions the Allied air forces reduced even more the anyhow greatly diminished punch of the Luftwaffe;
19. The Allied air attacks also destroyed the signal communications and air warning service facilities, thus depriving the German intermediate command of its "sight" which in turn complicated the operations and control of the flying units; and
20. By the far-reaching bombing attacks, the Allies produced effects where they were least expected.

The German fighter production reached its highwater mark in the last months of the war, but the air force which could fly these machines was shattered. It is useless to decompose POINTBLANK into its subcomponents and attempt to analyze them separately. The overall effect is what counts. The Luftwaffe lost the initiative and lost control of the air. The invasion could not be prevented and the war was lost.

LESSONS FROM THE BATTLE

The direct effects which the Combined Bomber Offensive brought to bear against the Luftwaffe destroyed the combat effectiveness of the dayfighters and rebounded throughout the entire force. Diversions from the main thrust of Combined Bomber operations against other target systems may have crippled their effectiveness, but no diversions were permitted from the number one target--the German air force-in-being. The planners understood clearly that any remission of pressure against the fighter force might immediately result in a loss of the initiative in the air and in the freedom to operate for both the bomber force and for the invading ground forces.

POINTBLANK presents a two-edged lesson to modern planners: (1) Concentrated counter air operations can destroy the effectiveness of an air force and (2) he who fails to seize the initiative and take the offensive in the air will become the recipient of the destructive effect of air attacks, first upon his basing structure and then upon the ground forces.

Modern ground strategies for NATO count heavily on the freedom to move forces on the lines of communications in order to meet enemy thrusts wherever they occur. Failure to seize rapidly and to maintain some measure of control of the air can only mean the failure of defensive operations on the ground.

OBSERVATIONS

- The airbase attack campaign embedded in POINTBLANK took the form of an offensive pursuit against the German fighter force. Units were repeatedly bombed off their primary operating locations and forced to disperse to austere locations from whence operations were hampered.
- The effects of airfield attacks were cumulative. Industrial targets could regenerate after an attack--some production was already in the pipeline, and the effect of successful attacks could be smoothed. The only product for air units was the timely delivery of combat sorties. Combat sorties not flown were lost forever.

- Repeated attacks forced the Germans to divert effort which could have supported sortie production into counter-measures--camouflage, dispersal, and hardening of airbase facilities.
- One effect of air attacks on the airbase structure was to compound the ground crew-to-aircraft ratio. The relative size of ground echelon to aircraft grew drastically once the bases were under attack.

1936 (estimate)	29-30 men per aircraft
1940	50-80 men per aircraft
1941	100-120 men per aircraft
1942	250 men per aircraft
1945	1000 men per aircraft

- Concentrated air operations immediately prior to the Normandy Invasion forced the dispersal of Luftwaffe units and thus compromised the striking power of ground support units.
- POINTBLANK's most important contribution was the provision of a planning framework. The POINTBLANK directive provided justification for the allocation of air effort and provided the logic for an entire campaign.

SECTION 7

UN FORCES IN KOREA 1950-1953

Airpower in the Korean conflict is now remembered primarily as the story of "MiG Alley"--the air-to-air battles of Sabre versus MiG which resulted in one of the highest kill-to-loss ratios ever achieved.¹ Underlying that victory, however, is an account of an airbase attack campaign which provided air superiority over North Korea so tightly held that Robert Futrell called it "the first of many unrealities of the Korean War."² It does indeed appear unlikely that such total domination of the airspace over an enemy territory could be achieved in any future conflict, but the lesson that Korea brings to modern planners is twofold:

Once air superiority is lost it may be most difficult to reestablish a capability to operate while under the watchful eyes of an enemy, and

The general benefit of air superiority is so elemental to all military operations that its value cannot be overestimated.

The Korean conflict presents few lessons in the areas of tactics or weaponry, but demonstrates conclusively the value of determination and high target priority in an airbase attack campaign. Once the fledgling North Korean Air Force (NKAF) was destroyed on its bases in the first days of the war, the base structure was kept under constant surveillance and subjected to heavy and well-timed attacks. The "Intelligence Roundup" publication of the Far East Air Force described this succinctly as the "Airfield Destruction Program."

From the beginning of the war, the destruction of North Korean airfields received high priority by UNC forces. This was consistent with the basic Air Force doctrine of obtaining air superiority through destruction of enemy aircraft and air facilities. Valuable lessons of planning and technique were discovered from these air attacks against enemy air fields. The Communists, making use of a reservoir of coolie labor, could repair a runway in a very short time. Therefore, timely and well-coordinated modest air raids, scheduled when photographic surveillance indicated that repairs had been effected paid greater dividends than spasmodic all-out air attacks against North Korean airfields.³

What the airfield destruction program could not handle was the Manchurian MiG bases across the Yalu. The political decision against attacks on this base structure may have been the sole factor which prevented the development of absolute air supremacy over the entire peninsula. The limitation was a prime interest in a contemporary account by Colonel Harrison R. Thyng,

The F-86 has a greater radius of action than the MiG-15, but we have not been able to exploit fully this tactical potential by striking enemy airpower deep behind the lines...The 86 could put the MiG so far away from the battlefield that the MiG would have no ground support capability and no possibility of attaining any aerial supremacy near the battlefield area.⁴

In fact, the high air-to-air kill ratio of the F-86 did accomplish the stated goal, but Colonel Thyng's point was well taken, and it is clear from contemporary intelligence reports that there was a constant concern that the NKAF would reestablish forward bases or would begin to operate in an air-to-ground mode against UN lines of communications, especially after the IL-28 light bomber was detected in Manchuria.

THE INITIAL AIR SITUATION

The North Korean surprise attack at 0400 on 25 June 1950 found the North Koreans with a clear numerical superiority in combat aircraft. As of June 29 the strength of the NKAF was estimated as 122 combat aircraft:

<u>Location</u>	<u>Type</u>	<u>Number</u>
Yompo	Yak-7B	10
Yompo	Yak-11	12
Yompo	IL-10	18
Sinmak	Yak-7B	10
Sinmak	IL-10	8
Pyongyang	IL-10	8
Pyongyang	Yak-7B	20
Pyongyang	Yak-11	2
Pyongyang	IL-10	40

In addition, the NKAF possessed some 30 other aircraft, including trainers and possibly some obsolete Japanese aircraft.⁵

Airfields with paved runways and support facilities were also available at Sinuiju, Wonsan, and Chongju. The main operating bases and reserve airfields were left from the Japanese occupation and in addition NKAF construction was underway at Sinmak and Pyongyang.

By April 1950, the Republic of Korea had organized an "air force" which consisted of sixteen aircraft (eight L-4s, five L-5s and three T-6s).⁶ The US presence in the Pacific was substantial. The order of battle claimed for the Far East Air Force (FEAF) consisting of the Fifth, Twentieth and Thirteenth Air Forces amounted to some 1200 combat and support aircraft of all types.⁷ These aircraft were based in an arc through the Japanese home islands, Okinawa, and the Philippines. Furthermore, the FEAF had been envisaged as primarily an air defense force; its largest single holding was in F-80s (504) and in all of Japan there were only four jet-capable runways.

The FEAF was short in almost everything it would take to sustain combat operations in Korea.

THE INITIAL MOVE

The NKAF, small as it was, made an early appearance attacking Kimpo airfield and Seoul Municipal Airfield, harassing USAF weather recon flights and supporting the invading ground forces.

On June 26, President Truman ordered positive action. All previous restrictions on FEAF were lifted on targets as far north as the thirty-eighth parallel. Immediately FEAF ordered the Fifth Air Force to "establish air superiority over South Korea" and to prevent North Korean interference with ROK troops or with the US evacuation of dependents.⁸

On June 29, the attack authorization was extended to allow attacks into North Korea against airfields, tank farms, troop columns, and other targets judged essential in clearing North Korean forces from the area south of the thirty-eighth parallel. The attack flights, however, were to

keep well clear of the Manchurian and USSR borders and, if attacked, were to "defend themselves without taking aggressive action until Washington could be advised."⁹

The first major airfield attack took place on this same day when eighteen B-26s from the Third Bombardment Group attacked Pyongyang airfield and claimed twenty-five aircraft destroyed on the ground plus one air-to-air kill by a B-26 gunner. On July 19, another strike against Pyongyang, this time by seven F-80s, was credited with at least fourteen fighters and one twin-engine bomber.¹⁰

The NKAF was continually active during this period in small harassing attacks against ROK troops, communications facilities, and ships operating in coastal waters. No concentrated operations of any kind were reported however, and by August 10, it was estimated that 110 aircraft of the original NKAF had been destroyed. The NKAF flew some attacks against naval vessels at the time of the Inchon landings, but was never again an effective combat force.

The destruction of the NKAF did not end the requirement nor the extreme concern over air superiority above the Korean peninsula. In fact, the political prohibitions against attacks on the Manchurian air bases combined with rapidly escalating estimates of the air threat facing the UN forces put operations designed to maintain territorial air superiority back at the top of the priority list. The estimates of total aircraft exist in the FEAF Intelligence Roundup:¹¹

	<u>USSR (FE)</u>	<u>PRC</u>	<u>NKAF</u>	<u>ROK</u>	<u>FEAF/UNC</u>
June 25, 1950	3500	87	150	16	1198
Nov. 26, 1950	5500	500	0	14	1667
July 10, 1951	5500	1300	?	14	1778

Whether these figures were totally accurate may be disputed, but the effect of their acceptance on evolving air target policy was unequivocal. While politically constrained from attacks on the entire enemy base structure, the air planners at the very least had to prohibit the loss of superiority over the peninsula which would surely result if the enemy was allowed to move aircraft south of the Yalu.

The allocation of air support was heavily biased toward direct support of troops in contact in the immediate aftermath of the Chinese intervention and was followed by the development of the air interdiction campaign sometimes called Operation Strangle. General Weyland, CinC FEAf, commented extensively on this campaign:

In accordance with the objective to deny the enemy the capability to launch and sustain a general offensive, the interdiction campaign had been intensified. This kind of attack had dealt the enemy a lethal blow in the fast-moving ground battle during the first year. The successes had closely paralleled those in Europe during World War II. With these successes in mind enthusiastic air force planners hoped to isolate the enemy so effectively that he would not be able to sustain his forces on the line. At some time--I cannot find when or where--Air Force officers or newspaper writers dubbed the first phase of the interdiction program OPERATION STRANGLE. I do not know just what degree of "strangle" this caption was supposed to denote. In retrospect I do know that it was an unfortunate selection of words, for it gave some who did not understand the real objective of the interdiction program a vehicle for proclaiming its failure.

If one assumes that the objective of the road and railroad interdiction was to deny the enemy the long-term capability to launch limited objective attacks, or even more, to deny him the capability to conduct an obstinate defense, then it did not do the job. On the other hand, it was an unqualified success in achieving its stated purpose, which was to deny the enemy the capability to launch and sustain a general offensive. Moreover the attritive effects of the interdiction program directly supported the other parallel objective of punishing the enemy to the maximum extent possible.¹²

By the final phase of the war interest had rekindled in the airfield destruction campaign. This interest was driven by two factors:

- (1) The general and continuing concern that forward basing of enemy aircraft would subject UN ground forces to a level of air attack beyond FEAf's defensive capacity; and

- (2) The expectation that the enemy would attempt to exploit the forthcoming armistice by deploying a numerically large air force into North Korea at the last minute to serve as "forces in being" at the conclusion of the agreement.

General Weyland pointed out that the threat of forward deployment had begun in late 1951:

The story of the war in the air has been well told. UNC Air Forces killed over 840 MiGs at a greater than 10-to-1 ratio. What is not so well known is the determined effort the enemy made to establish the force on forward air bases in Korea. He surmised that if he employed his air force from China and Manchuria against UNC air bases and troops, the UNC Air Forces would strike back across the Yalu. He felt compelled to take some action to ward off the continuing air attacks. Therefore, late in 1951, he planned and started building an extensive system of airfields reaching well down toward South Korea. When UNC Air Forces set out to destroy these fields just as they were nearing completion, the enemy reacted violently. His greatest protective fighter attacks were launched against the destroying bombers and fighters. Some of his heaviest anti-aircraft concentrations were thrown up around the airfields. Repeatedly he tried to repair the damage and complete the job, and just as often the bases were destroyed.¹³

On July 10, 1952, FEAF, with recognition that the ground war had become static and that the Communist forces were operating with relatively short supply lines, instituted a new operational policy which moved away from an emphasis on delay and disruption of enemy combat forces and began to emphasize destruction of enemy forces. The priority of each target was specified:

- (1) aircraft,
- (2) serviceable airfields,
- (3) electric power facilities;
- (4) radar equipment,
- (5) manufacturing facilities,
- (6) communications centers,
- (7) military headquarters

- (8) rail repair facilities,
- (9) vehicle repair facilities,
- (10) locomotives,
- (11) supply, ordnance and POL,
- (12) rail cars,
- (13) vehicles,
- (14) military personnel,
- (15) rail bridges and tunnels,
- (16) marshalling yards as facilities, and
- (17) road bridges.¹⁴

The first priority target covered air-to-air operations as well as air-to-ground attacks. Until July 1952, the Sabre wings had operated in a defensive counter air mode designed to protect slow movers against MiG attacks. With this change in policy, the patrols along the Yalu were to seek combat with the enemy fighters as a means of maximizing attrition against the enemy fighter force which was based in sanctuary.

The general policy remained in effect until May 1953 when it was augmented with plans for the "final" airfield neutralization. General Weyland listed a total of thirty-five North Korean airfields which were to be kept under constant surveillance and attacked as appropriate. Attacks on the entire base structure were authorized in early June when armistice appeared imminent, and by June 23, FEAF thought it doubtful that a single airfield in North Korea could service tactical aircraft.¹⁵

The prospects for armistice dimmed and the Korean summer weather closed in after the twenty-third. Reconnaissance was hampered and desultory radar-directed bomb sorties were mounted to slow whatever repair activity might be underway. On 4 July, B-29s attacked Pyongyang Main with 500 pounders and followed up with attacks on Namsi and Taechon some five days later.

On July 17, photoreconnaissance revealed forty-three MiG15s parked in revetments at Uiju with 5500 feet of sod runway in use. On the night of July 21-22, B-29s attacked Uiju with M-26 fragmentation bombs and M20 incendiaries and were credited with the destruction of thirty-six revetted

aircraft. A spasm of airfield attacks was once again undertaken with the realization that the armistice was imminent. The criterion used for airfield destruction was "no intact takeoff or landing surface longer than 3000 feet." Final intelligence analysis revealed that the North Koreans had managed to fly in some 200 aircraft to Uiju. The aircraft had been towed away from the airfield into the surrounding countryside and most were in a damaged condition. As General Weyland put it, "...the enemy had learned the basic lesson that an air force cannot be reconstituted or developed in an area where his foe has won air supremacy."¹⁶

LESSONS FROM THE BATTLE

Air superiority took a premier place in the allocation of airpower in the Korean conflict. The necessity to devote continued bombing sorties to airfield attacks was caused in part by a political decision which afforded the enemy a sanctuary, but it was also strongly supported by the total air superiority over the South which was rapidly developed in the first days of the war.

OBSERVATIONS

- *The "airfield destruction program" was supported by a fully developed planning and prioritization system.*
- *The availability of B-29 aircraft meant that saturation attacks against the airfield facilities was a feasible approach.*
- *Seizure of control of the air as an initial move was critical to the ground campaign.*

SECTION 8

AIRFIELD ATTACK IN THE MIDDLE EAST CONFLICTS

THE SUEZ WAR (OCTOBER-NOVEMBER 1956)

The experience of air warfare in the 1956, 1967 and 1973 conflicts in the Middle East have provided "laboratory results" that have significantly influenced the manner in which the airfield attack problem is viewed today. The 1956 Suez War represented a jet-powered replay of the classic World War II airfield attack pattern - high altitude, pathfinder-supported bombing coordinated with low-level attacks by fighter-bombers. This formula worked in 1956, and enabled effective destruction of the Egyptian Air Force (EAF) in about three days by British and French aircraft. Israeli Air Force (IAF) participation in the airfield attack operation was precluded by both operational and political considerations. This was not the case in the Six Day War of 1967. The devastating IAF attacks on Egyptian, Jordanian and Syrian airfields (nearly 400 aircraft destroyed on the ground) were precisely planned and executed; and combined with the Israeli's overwhelming superiority in air-to-air combat, effectively removed the Arab air forces from the battlefield. The success of the initial surprise attacks on these airfields was probably the single most important impetus to Soviet and NATO development and deployment of the individual hardened aircraft hangarette. The presence of these hangarettes on many Arab airfields during the 1973 Yom Kippur War dramatically limited losses on the ground to only four percent of the ground losses of 1967. Despite this added protection, however, the continued Israeli superiority in air-to-air combat, the effectiveness of Israeli ground defenses, and a serious failure in air defense coordination by the Arabs combined to raise total Arab losses by twelve percent over 1967. The hangarette was a strong benefit only if forces stood down, and an effective, though limited, Israeli runway interdiction program denied even the sanctity of the hardened airbases. The 1973 war also provided the first real test of a technically sophisticated (in equipment if not in coordination) air defense network against a well trained and well equipped Western air force that was intent, at least in part, on a counter

air campaign. The result continues to influence doctrinal thinking and technical developments in NATO and the Warsaw Pact.

Counter air strikes against Egyptian airfields were key element of a the British and French strategy during the conflict. The campaign was designed to effectively eliminate the Egyptian Air Force (EAF) prior to seizure of the Suez Canal by paratroop and amphibious landings. The strikes were carried out by a combined "Allied" force of Royal Air Force (RAF), Royal Navy and French Air Force (FAF) and Navy bombers and fighter-bombers. The Israeli Air Force did not participate in this operation.

In many ways the counter air campaign was a replay of World War II using a primarily jet-powered strike force. Most target airfields possessed multiple intersecting runways and several had dispersed, revetted aircraft hardstands. The use of some camouflage was also reported.¹ Bomber strikes were made from high altitude and fighter-bombers conducted lowlevel strafing attacks and some dive-bombing. The basic plan was for the bombers to crater runways and destroy airfield installations in initial nighttime attacks. Fighter-bombers would then attack the pinned-down EAF aircraft in daylight strikes. The overall success of the plan was demonstrated by the reported destruction or damage of at least 400 EAF aircraft (out of a total of 500 aircraft of all types).

THE TARGET

In late 1956 the EAF was in the midst of an expansion and training program designed to utilize the nearly 200 Soviet jet fighters and bombers that had been delivered beginning in late 1955. Formerly classified RAF estimates² provide the most authoritative data on EAF aircraft strength at the time of the Suez operation:

- 126 MIG jet fighters (mostly MIG-15s and apparently a few MIG-17s; eighty-six aircraft known to have been delivered and forty further aircraft known to have been on order and believed delivered);

- Sixty-four IL-28 jet bombers (forty-nine known delivered and fifteen more probably delivered);
- Twenty-nine Meteor jet fighters (including thirteen Meteor N.F.-13 night fighters - the only all weather interceptors in EAF service);
- Seventy-eight Vampire jet fighters;
- Forty-three Transports.

Of the 297 jet aircraft available, only sixty percent (172) were assigned to flying units, according to the best available EAF air order-of-battle (AOB) (published by Israeli General Moshe Dayan in his diary of The Sinai Campaign). The combat units in this AOB are shown in Appendix E, Table 1. Even the AOB was deceptive since the Egyptians had jet pilots for only about thirty percent of the unit-assigned aircraft.³

Many of the airfields that the EAF had inherited from the RAF in 1955-56 were deteriorating and required improvement. The typical EAF air field consisted of from three to four runways in classic intersecting patterns positioned at 45° or 90° angles from each other. Most had main runways of about 6000 ft. in length. By October 1956, the Egyptians had extended the most important of these airfields to about 9000 ft. to accommodate their newly received Soviet combat aircraft. Appendix E, Table 2 provides runway data for the most important military and civilian airfields and indicates whether available data reflected attacks on them. The airfields are numbered and the numbers are keyed to two maps (Appendix E, Figures 1 and 2) depicting their locations. Most of the military airfields had dispersal areas served by perimeter taxiways and a number of these areas were revetted.

THE STRIKE FORCE

The strike and strike support force totaling an estimated 374 aircraft⁴ was made up of land-based RAF and FAF aircraft and carrier-based Royal Navy and French units. The RAF deployed over 100 Valiant B.Mk.1 medium and Canberra B.2 and B.6 light jet bombers (ten full squadrons and

detachments--presumed to represent flights of at least four aircraft--from seven other squadrons) to airfields on Malta and Cyprus. This force represented nearly half the operational jet bombers in Bomber Command in October 1956. An additional two squadrons of Hunter F.5 jet fighters (thirty-two aircraft) deployed from Fighter Command bases to Cyprus to supplement the four Venom fighter-bomber squadrons normally based there. The FAF sent one squadron of F-84F fighter-bombers and, apparently, two squadrons of Mystere IV A fighters to Israel and another squadron of F-84Fs to Cyprus, a total of at least seventy-two aircraft.⁵ The Royal Navy deployed a three carrier task force, H.M.S. Albion, H.M.S. Bulwark and H.M.S. Eagle with a total of six squadrons of Sea Hawk F.B.4 fighter-bombers, five squadrons of Sea Venom F.21 and F.22 fighters and two squadrons of Wyvern turbo-prop fighter-bombers. The task force was reinforced by two French aircraft carriers; the Arromanches and the Lafayette with two squadrons of F4U Corsair and one squadron of TBM Avenger propeller-driven fighters. Additionally, pre-and post-strike tactical reconnaissance was provided by a squadron of Canberra P.R.7s based in Cyprus, Valiant B.(P.R.)1s and a squadron of FAF RF-84Fs deployed to Cyprus (all at Akrotiri, probably to coordinate operations and photo analysis). Appendix E, Table 3 provides a breakdown of airfield and carrier unit basing and Table 4 shows the aircraft strength by base/carrier.

THE ATTACK

The air strikes were preceded by four photo-reconnaissance sorties over Egypt flown by Canberra P.R.7s early on 30 October 1956 providing detailed information for strike planning.⁶ The initial strikes were planned for a "no-moon" period with EAF airfields as the first priority target. The first attack on the night of 31 October by Canberras and Valiants from Cyprus and Malta was directed against at least five airfields - Abu Suweir, Almaza, Cairo West, Inchas and Kabrit. Canberras flew low-level pathfinder missions (a World War II practice) using parachute flares to identify the targets and confirm the aiming points, marking the runway intersections with colored target markers. In one case

the Valiant formation bombing Almaza made two runs prior to bombing on the markers and spent fifteen minutes over the target.⁷ These bombing procedures were apparently used because of an emphasis placed on bombing accuracy. Subsequent to target confirmation the airfields were bombed from high altitude (uniformly over 40,000 ft. and as high as 49,000 ft. in some cases) by a combined force of Valiants and Canberras using 500 and 1000 lb bombs, some of which had delayed action fusing. Bomb sizes were reportedly limited for "humanitarian reasons." The bomber crews reported almost two hours of inaccurate flak up to 8000 feet and aside from one inconclusive "near-interception" of a Valiant by a Meteor N.F.13,⁸ no fighter opposition. One raid (by Valiants) against Cairo West was cancelled just prior to reaching target because of reports of convoys of American citizens in the area. Official announcements indicated that post strike reconnaissance flown by Canberra P.R.7s in the morning (1 November) reflected accurate bombing of runways and key airfield installations. Although some subsequent open source articles disputed the initial results, available intelligence evidence⁹ along with data from General Dayan's book indicates that no EAF sorties were flown over the Sinai after 31 October (forty to fifty on 30 October and 90-100 on the 31st). Although it was alleged that Nasser ordered the EAF to cease operations over the Sinai on 1 November, the timing suggests propaganda tailored to fit the reality of the results of the initial strikes.

At first light on 1 November, low-level fighter-bomber attacks on EAF airfields began. Carrier-based aircraft attacked airfields in the Nile Delta and the Cyprus-based Venom and F-84F fighter-bombers concentrated on the Canal Zone airfields. Because of expected strong fighter opposition only jet aircraft were allowed inland. Turbo-prop Wyverns were restricted to coastal targets and the French Navy's propeller-driven aircraft to offshore targets of opportunity. The four airfields attacked during the night were struck again and at least five additional airfields in the Canal Zone area were hit. One Venom squadron claimed fourteen aircraft destroyed, including several MIG-15s, and ten damaged. The 1st Royal Navy strike, consisting of forty Sea Hawks and Sea Venoms (single aircraft in a

lead navigation role with each Sea Hawk formation),¹⁰ strafed "many" MIGs and IL-28s encountering only light flak and no fighter opposition. Fighter-bomber operations continued throughout the day and Wyverns hit coastal airfields once it became apparent that there was no fighter opposition. In addition to airfields, the facility housing Radio Cairo was also attacked by twenty Canberras flying at low level with F-84F escort. This attack was reportedly unsuccessful.¹¹ Available evidence indicates that Cyprus-based F-84Fs attacked IL-28s on the airfield at Luxor, possibly on 1 November. The aircraft were reported to have refueled at Lydda Airport in Israel to lessen the range problem (Lydda is 400 nm from Luxor, the distance from Akrotiri to Luxor is 535 nm). This was apparently the raid whose success was announced by the French on 6 November indicating that photoreconnaissance had confirmed the destruction of eighteen IL-28s by French fighters in an "earlier raid." This subterfuge suggested a degree of political sensitivity to the FAF operations from Israeli airfields.¹² A French general alleges that RAF bombers were also involved in this raid¹³ although official RAF reports place their Luxor raids on the night of 2/3 November and 4 November. If the AOB offered by General Dayan (Table 1) is correct then there was some real imperative to hit these aircraft early in the campaign. The disparity between the alleged dates and participants in the Luxor attacks remains unresolved but the results are not. After extensive photoreconnaissance, the results of the first 24 hours of operations were announced early on 2 November. Over fifty EAF aircraft were claimed as destroyed and forty damaged with no Allied losses.

Fighter-bomber raids ceased at dusk on 1 November and Valiants and Canberras resumed their pathfinder-supported high altitude attacks which continued throughout the night. Valiants struck Cairo West for the first time and bomb concentrations were reported on the runway intersections. At least Kabrit and Inchas were both reported to have been struck again with further extensive runway cratering evident in Canberra photo-reconnaissance coverage flown in the morning (2 November) at 30,000 ft. This coverage also indicated that approximately 100 EAF aircraft including "many" MIG-15s and IL-28s had been destroyed up to that time.

Fighter-bomber activity resumed on 2 November with a pre-dawn strike, but EAF combat aircraft became increasingly harder to find so the attacking aircraft began destroying trainers. By midday, it had become apparent that the initial objective had been achieved at least in the area of the Nile Delta and the Canal Zone so a portion of the strike sorties were redirected to Army installations in preparation for the assault landing. AAA remained intense but inaccurate. At least one EAF airfield was reported completely abandoned. Photoreconnaissance flown during the day suggested that some EAF aircraft were being evacuated to other countries.¹⁴

On the night of 2 November, Valiants and Canberras from Malta and Cyprus bombed the IL-28 base at Luxor for the first time. Army installations in the Delta were also struck by these aircraft. Sometime on the night of 2 November or early on the third, one Canberra sustained minor damage from a MIG-15 attack. Planning for the employment of the carriers envisioned a maximum effort on the first two days to support the counter air campaign and again on the day of the landing to support the ground element (the sixth day in the original planning). Because of the success achieved against the initial objective, the H.M.S. Albion was allowed to withdraw during the night of the second for underway replenishment.

On 3 November, the Allies announced the EAF's destruction as an "effective force" and reported that all Egyptian military airfields had been seriously damaged. Intermittent fighter-bomber attacks on the airfields continued during the day to insure the continuing air superiority. French Navy aircraft joined these operations and lost one airplane to AAA. The bulk of air strikes were shifted to other ground installations including ammunition dumps, AAA batteries, radar sites, barracks areas and tank parks. Hawker Hunters were used for the first time, to escort Canberras bombing a major army base at Almaza (Sea Hawks also struck the same installation). Canberras bombed the Radio Cairo transmitter again, this time successfully.

No bombing raids were flown on the night of 3-4 November, but an unescorted British transport dropped propaganda leaflets over Cairo. The last raids by bombers occurred on 4 November. The targets included Luxor

airfield and some installations near Cairo. Combat aircraft at Cairo International Airport were also attacked by fighter-bombers on the fourth. Official estimates indicated that eighty percent of the EAF had been put out of action by this date.¹⁵ Fighter-bombers hit Almaza on 5 November and some airfields were also attacked on the sixth. Offensive air operations ended with the cease fire at midnight on the sixth.

RESULTS

The Allied counter air campaign was successful in establishing full control of the airspace in northern Egypt and eliminating the EAF as a threat to that control. They were assisted in part by the lack of jet-qualified and combat-capable EAF pilots, the poor state of EAF operational readiness and Egypt's lack of a coordinated, integrated air defense system (although the Egyptians did effect a sustained, if highly ineffective, AAA defense). Additionally the RAF's intimate knowledge of EAF strength and the target set undoubtedly assisted strike planning and their estimate of the air defense threat.

On November 9, 1956 the French Defence Minister gave the total EAF losses as 200 destroyed and seventy damaged. Most postwar open source reporting suggests that 250-260 aircraft were destroyed, however, a post war issue of The Aeroplane magazine (23 November 1956) quotes "the latest Allied report on the EAF" stating "that nearly 400 of the total of 500 aircraft were destroyed on the ground." This report is of interest and may be the most authoritative since:

- (1) It agrees with the 4 November Allied report that four-fifths of the EAF had been put out of action.
- (2) Detailed analysis of available AOB data including some formerly classified data indicates that the total number of military aircraft in Egypt at the time of the attack was approximately 520 including:

126 EAF MIG-15/17

31 Syrian A.F. MIG-15/MIG-15UTI (Based at Abu Suweir for training Syrian pilots)

64 IL-28
29 Meteor
78 Vampire
43 Transports
8 Fury Fighters
6 WW II Bombers
135 Trainers
520

In addition to aircraft losses it appears that a number of EAF bases (but not all, to judge from the occasional combat sortie) were rendered unusable for the period of the war. Although priority repairs on some Canal Zone airfields began immediately after the cease fire and Abu Suweir received two MIG-15s as early as 21 November 1956, the USAF Aeronautical Approach Chart for the central Canal Zone area (447 AIII) with January 1957 air information reflects only two military airfields as open - Abu Suweir and Shallufa and four others as still closed - Deversoir, Fayid, Kabrit and Kasfareet (a July 1957 chart - PC447A reflects the latter as open).

Complete sortie data is not available. The RAF and the Royal Navy are known to have flown more than 5000 sorties overall, including extensive support to the amphibious landing. Of these the Royal Navy flew 1500, of which 355 were flown the first day. Some further idea of the character of the air strikes is provided by complete figures available for the H.M.S. Eagle's forty combat aircraft:

- (1) Six days of operations,
- (2) 621 catapult launches (presumably includes four Skyraider early warning aircraft),
- (3) 72 x 1000 lb. bombs dropped,
- (4) 157 x 500 lb. bombs dropped,
- (5) 1448 x 3" rockets fired, and
- (6) 88000 rounds of 20mm ammunition expended.¹⁶

A total of six RAF and two Royal Navy aircraft were lost during the operation, of which five were due to enemy action (AAA). No sortie data is available for the French but two French aircraft were lost (one to AAA).

LESSONS FROM THE BATTLE

In 1956, both the British and the French were experienced, well-trained and reasonably well-equipped combat forces. They conducted a classic World War II-style counter air campaign over distances of between 300 and 1,000 miles. They operated against a reasonably well-equipped force with little potential because of inexperience and lack of training and organization. These Egyptian problems allowed the allies to employ World War II flying tactics--pathfinder-supported high altitude night bombing and subsequent daylight low altitude fighter attacks. Taking advantage of the EAF's relative lack of a night defense capability the initial night raids rapidly degraded the small number of jet-capable EAF bases and destroyed a portion of the undispersed aircraft on them. This enabled unopposed operation by the British and French fighters in subsequent attacks. Exploitation of this key weakness minimized the risk to the British since initial attacks in daylight could, potentially, have been more costly for the bomber forces. In the end, Egypt's only recourse against the airfield attack campaign was to fly surviving aircraft out of the country. The rapid, relatively cost-free success of the counter air campaign pointed up the EAF's need for a broader and denser siting of air-fields, increased aircraft protection, and improved night defense capability.

OBSERVATIONS

- While planning for the 1956 attack was demonstrably done on a rapid, ad hoc basis, the British possessed excellent intelligence on the Egyptian Air force and a detailed, intimate knowledge of the Egyptian air-bases all of which they had originally constructed.
- The British approach was to carry out pathfinder-supported anti-runway attacks designed to trap the Egyptian aircraft for subsequent destruction by fighter-bomber attacks.

- Given the state of the EAF's development it is unlikely they could have provided a great deal of opposition under even favorable circumstances. British employment of bombing aircraft with greater speed and altitude capability than the meagre EAF night-fighter force was used to overwhelming advantage.

SECTION 9

THE SIX DAY WAR, JUNE 1967

From a historical standpoint Israeli Air Force operations against the Arab air forces in the 1967 war represent the most rapid, clear cut success in the conduct of a counter air campaign since World War II. The effectiveness of the Israeli airstrikes in this conflict and the associated critical intelligence, planning, and execution factors that contributed to the operation induced both NATO and the Warsaw Pact to focus resources on airfield survivability issues that were previously neglected.

Operational factors contributing to the IAF's success included:

- (1) Excellent intelligence contributing to the degree of surprise, attack precision, and the careful calculation of risks in the execution of attacks;
- (2) Detailed planning and extensive training;
- (3) Precision gunnery and bombing;
- (4) Force utilization; and
- (5) Sustained sortie generation.

The readiness status and dispersal posture of the Egyptian Air Force also contributed to the IAF's success. A 26 May 1967 Soviet inspection report of EAF bases¹ noted that:

- (1) Some EAF pilots had not flown for days;
- (2) Dummy aircraft positioned on or near runways were not convincing; and
- (3) Real aircraft were often massed together making them good targets.

There was also no apparent program in evidence to disperse significant portions of the EAF, especially the TU-16s, to remote Egyptian bases out of range of IAF aircraft.

EGYPTIAN AIRFIELDS

Subsequent to the Suez War the Egyptians began a significant expansion of their airfield infrastructure. From the eight really significant military and civilian airfields available in October 1956 the number of jet-capable military airfields had grown to at least twenty-three by June 1967. These are listed in Appendix F, Table 1 with numbers keyed to the maps in Appendix F, Figures 1 and 2. Most of the new airfields were built in the apparent classic Soviet² (and NATO) style with a single runway and a full length parallel taxiway. New airfields in the Sinai (Bir Gifgafa, Bir Thamada and Gebel Libni) and along the Red Sea coast (Hurghada and Ras Banas) were apparently part of a Soviet aid package initiated in 1959. Reconnaissance photos indicate that there were dispersal areas at most EAF bases and that some fighters and most of the large aircraft (TU-16 BADGERS and AN-12 CUBs) were parked in high walled revetments.

EGYPTIAN AIR FORCE STRENGTH AND DISPOSITION

In 1967, with Soviet assistance, the EAF had grown to a force of approximately 450-500 combat aircraft. Available force breakdown (from various sources) is as follows:

120-140 MIG-21
60-80 MIG-19
150-180 MIG-17 and MIG-15
20-40 SU-7
30 TU-16
40-45 IL-28

Additionally the following support aircraft were available:

<u>90 Transports</u>	<u>60 Helicopters</u>	<u>120 Trainers</u>
60 IL-14	12 MI-6	
25 AN-12	29 MI-4	
? AN-24		

The EAF serviceability was reportedly around eighty percent⁴ and sixty EAF aircraft were believed to be operating in Yemen at the time of the war.⁵ Open source literature and IAF targeting provide a fairly good picture of the disposition of the EAF in June 1967 and this is shown in Appendix F, Table 2.

SYRIAN AIRFIELDS AND AIR FORCE

Like the Egyptians, the Syrians began a Soviet-assisted expansion of their airfield network. Only two or three jet-capable airfields existed in Syria in October 1956. By June 1967 at least ten and possibly more jet-capable airfields were in use. These are listed in Appendix F, Table 3 and are depicted in Appendix F, Figure 3. The Syrian Air Force had between eighty and 120 combat aircraft including:

4-6 IL-28

30-40 MIG-21

20 MIG-19

30-60 MIG-17

As in the case of Egypt, IAF targeting intelligence and open source information provided a fairly comprehensive picture of Syrian Air Force unit basing. This is shown in Appendix F, Table 4.

JORDANIAN AIRFIELDS AND AIR FORCE

In 1967, the Jordanian Air Force had thirty-four combat aircraft: five F-104As; twenty-one Hunter F-6s; and eight Vampire F.B.5s. Two jet-capable bases were in use, Amman and King Hussein (near Mafraq). Both are shown in Appendix F, Figure 4 as number 7 and number 8 respectively.

ARAB AIR DEFENSE

According to General Hod the Egyptians had twenty-seven operational SA-2 SAM sites in June 1967, apparently sited to protect airfields. Cairo

West, for example, was reported to have five SA-2 sites in the vicinity in addition to a great deal of AAA. The SA-2 sites were located in the Nile Delta area with at least one site in the Sinai (near Bir Gifgafa airbase). The Egyptians were reported to have large quantities of Soviet AAA guns including Quad 12.7mm, 37mm, 57mm, 85mm, and possibly some 100mm. In addition, tracked SU 57-2 mobile AAA vehicles were in use. At least some of the 57mm and 85mm guns were sited to defend SA-2 sites in a manner similar to that used by the North Vietnamese (in effect creating "flak traps"). The Egyptians possessed an integrated radar network with at least two dozen radar sets which covered northern Egypt and the Sinai area. The Syrians also had AAA and a radar network but reportedly no SA-2s (although some sites were under construction). Jordan had some modern British radar equipment (at least one Marconi 547 early warning radar) and probably some AAA.

ISRAELI AIR FORCE STRENGTH AND DISPOSITION

Most sources are in general agreement concerning the approximate number of combat aircraft available to the IAF on 5 June 1967. The most authoritative of these is General Weizman, IAF commander from 1958 to 1966 and Chief of the Israeli General Staff at the time of the 1967 war. He indicated in his autobiography⁷ that 196 operational combat aircraft were available on 5 June. If General Hod's serviceability claim of ninety-nine percent on that date is correct then the IAF actually had 198 combat aircraft. This total breaks down as follows:

70-72 MIRAGE III C J

20 VAUTOUR

18-20 SUPER MYSTERE

40-45 MYSTERE IV A

40-45 OURAGAN

These aircraft were probably distributed between four primary military air bases available in Israel in 1967: Ramat David, Eqron, Hatserim, and Hatzor. There were some reports that Lod (Lydda) Airport was used by

combat aircraft but this cannot be confirmed. Hatserim represented an increase of one new major military airfield over the 1956 war although the others had lengthened runways and other improvements which had been applied in the interim. These airfields, along with Lod Airport and one decoy airfield are identified in Appendix F, Table 5 and shown on the accompanying map (Figure 4).

THE AIR STRIKES

Israeli Planning

The basic IAF airfield attack plan apparently evolved from objectives originally promulgated when the IAF came into existence in 1948. General Hod, the IAF Commander, in a January 1968 discussion with USAF Air Staff personnel⁸ indicated the plan was rehearsed and evolved over the years as forces were developed, equipped and trained. The IAF kept it simple with no complicated coordination and at the time of the attack, carried out the operation almost ninety-five percent as planned.⁸ Regular IAF training in support of the plan included:

- (1) Practice attacks on mock enemy airfields in the Sinai with an emphasis on accurate gunnery (the latest flown two weeks before the war);
- (2) Large scale exercises every four months on the ranges using practice bombs;
- (3) One very large annual exercise emphasizing:
 - (a) timing,
 - (b) control coordination,
 - (c) refueling,
 - (d) turnaround techniques, and
 - (e) gunnery/bombing accuracy.⁹

Israeli planning emphasized high wartime sortie rates and supported this goal through intensive training¹⁰ to lower aircraft turn-around times

on the ground; and provision for the institution of an emergency maintenance program to raise the normal seventy-five to eighty percent in-commission rate to 100 percent in a very short time.

Israeli intelligence elements provided precise information on the disposition of Arab offensive and defensive elements which enabled effective utilization of forces by the IAF. Part of this information was obtained by occasional deep penetrations¹¹ of Arab territory by IAF reconnaissance aircraft. The precise data obtained by these missions and more frequent shallow penetrations¹² contributed to weekly briefings received by the IAF pilots on the state of their assigned targets in Egypt. The re-direction of most of the IAF's third strike sorties on 5 June to Syrian and Jordanian targets (some missions reportedly were scrubbed on the runways) indicates that the Israeli pilots were also pre-briefed on the targets of other Arab air forces.

The attack plan restricted the IAF to military targets (this was not to be the case in the attacks on Syria in the Yom Kippur war). Subsequent to a political decision for war, the force structure, targets and timing were General Hod's responsibility. Egypt had the highest priority for three reasons:

- (1) IAF understanding of Egyptian C² indicated that there would be a period of confusion after the attack began before Egypt became cognizant of what was happening;
- (2) Communications between Egypt and the other Arab countries would be degraded;
- (3) The IAF did not have the force strength to attack Egypt and the other Arab countries simultaneously.

The IAF originally calculated that it would have two hours to neutralize the EAF before it would have to face the other Arab air forces. Targeting priority in order of importance was:

- (1) Bombers (which could strike Israel);
- (2) MIG-21s (the highest performance EAF aircraft); and
- (3) Fighter-bombers (which could attack ground forces).

In addition, both SAM and radar sites were considered targets of opportunity.¹³

The initial attack wave against ten airfields on 5 June was directed solely toward airfields that held bombers or MIG-21s except for forward positioned airfields which posed a threat because of proximity to Israel. The initial attack covered four airfields in the Sinai (one of which, in fact, had MIG-21s), one on the Suez Canal, the three airfields with TU-16 and IL-28 bombers (two of which also had MIG-21s) and two other MIG-21 bases.

As previously noted, the IAF had 196 operational combat aircraft available. Although General Hod claimed after the war that the IAF was ninety-nine percent serviceable at the beginning of the war (and throughout) and that no aircraft was on the ground or under repair for more than an hour, other reports suggest that the actual in-commission rate was probably closer to ninety percent.¹⁴ A ninety percent rate would have meant that the IAF could actually have had a total strength of 217 combat aircraft.

Four flights of four aircraft each were assigned to attack each of the ten airfields in timed, sequential order¹⁵ enabling maximum continuous effect by a total of 160 aircraft. There were also, reportedly, some aircraft assigned to Combat Air Patrol (CAP) over Egyptian territory, although General Hod did not mention this. If open source reports that twelve aircraft were left for defense of Israeli airspace (initially all on ground alert and two flights of four each airborne later) were correct, then twenty-four aircraft were available for CAP. The IAF apparently accepted the risk posed by a minimum air defense posture in order to deliver the maximum possible weight of effort in surprise.

The airfield attacks were timed to begin at 0745 (Israeli time) which was calculated as the most advantageous time for a number of operational reasons:¹⁶

- (1) The EAF had maintained MIG-21 flights on five-minute alert at dawn (0400 Israeli time) every morning since the beginning of their troop concentrations in the Sinai desert in mid-May. In addition, they flew fighter patrols at half-hour intervals during the early morning hours since it was considered an ideal time for

attack (it could be speculated that the EAF remembered the Allied fighter-bomber attacks at "first light" in the 1956 war). The IAF calculated that these patrols would cease and that the EAF would lessen its alert including the number of early warning radars in operation by about 0730.

- (2) Attacking at 0745 would ease the expected pilot fatigue factor and allow the IAF pilots to sleep until 0400 (given a three hour preparation time). An attack at dawn would mean getting up at midnight or probably not sleeping at all (in other words, no sleep for thirty-six hours by the end of the first day).
- (3) A morning mist covered much of the Nile Delta and the Suez Canal at this time of year but usually dispersed by about 0730. Optimum weather occurred at about 0800 with an ideal sun angle and still air. One of the initial 0745 strikes (at Fayid) was delayed a few minutes because the airfield was still half-covered with mist at the planned time-on-target (TOT).
- (4) 0745 Israeli time is 0845 Egyptian time. Striking at 0845 would catch many military personnel in transit to work, especially command personnel. One other possible reason was mentioned by the Egyptian journalist Heikal in a postwar news article.¹⁸ At 0800 (Cairo time) on 5 June, an IL-14 CRATE took off from Cairo (probably Cairo West) with Field-Marshall Amen, the EAF commander Lt. General Mahmoud, and several General Staff officers, for Bir Thamada airfield in the Sinai to visit all the division commanders. Heikal speculated that the Israelis may have broken an Egyptian cipher, learned of the visit, and timed their attack to have these key officers, as well as those who had seen them off and those waiting for them in the Sinai, away from their command posts at the time of the attack. The Israelis say that this incident was an unanticipated advantage and that, in fact, General Hod was concerned when the IL-14 appeared on Israeli radar screens at 0730 (Israeli time) that it was a EAF

reconnaissance flight about to detect the in-bound attack aircraft.¹⁹ In any case, the IL-14 arrived at Bir Thamada in the midst of the attack, found that it couldn't land, returned to its base of origin, found that it too was under attack and finally landed at Cairo International Airport at 1015 Egyptian time, ninety minutes after the beginning of the air strikes. In addition to its disruptive effect on Egypt C² the events surrounding this incident had an added effect. General Hod indicated after the war that units in the Sinai had been in a state of constant alert during the early morning hours of 3 and 4 June but not on 5 June. This was because to insure the safety of the IL-14 VIP flight, orders had been given not to open fire on any aircraft over the Sinai on the morning of 5 June. If this order was passed to any deployed air defense units in the Sinai over unsecure communications means or compromised in administrative phone calls as could easily happen when high ranking officers make inspection tours, then Heikal's contention could have further merit.

Egyptian Operations and Planning Failures

In addition to EAF operational shortcomings mentioned previously, air defense reaction time was also poor. Prior to the war, interceptors scrambled in reaction to Israeli reconnaissance flights rarely reacted in less than three minutes and sometimes took as long as twenty-six minutes.²⁰ Failures in analytic and command judgment were also in evidence. President Nasser was given assurances from both the army and air force commanders that Egypt could sustain an Israeli air strike and still win. The EAF commander, General Mahmoud produced the critical estimate that EAF aircraft losses would total no more than twenty percent in the event of an Israeli pre-emptive air strike.²¹ Captured Egyptian documents also show an incorrect estimate of two sorties a day for each Israeli aircraft.²² In

considering this estimate one may note the previously mentioned EAF eighty percent serviceability rate, and that under Soviet training the Egyptians had reportedly achieved a two-hour turn-around time, which was generally considered adequate.^{22, 23} Additionally, the Egyptians reportedly assumed that any Israeli pre-emptive strike would be directed initially at their extensive early warning radar net to blind the system and that this would in itself be a form of warning. All of the aforementioned estimates and assumptions turned out to be wrong. Beyond these estimates there is evidence that some adequate warning of the attack was available. The former commander of the EAF in the Sinai, General Daghidy, claimed in a 29 June 1973 letter to the Beirut magazine *Al Hawadess* that four separate warnings were sent to Egyptian forces on 4-5 June:

- (1) One from President Nasser two days before;
- (2) One from an intelligence officer in Al Arish;
- (3) An army report of preliminary skirmishes; and
- (4) A radar report of IAF aircraft launches.

General Daghidy claimed that none of these reports reached him, apparently because cipher keys were being changed on the morning of 5 June. The general also claimed that he was the only senior officer at his post when the attack began.²⁴

Preparation and Initial Attacks on 5 June

Preliminary elements of Operation FOCUS (the codename for the IAF attack) were implemented in mid-May 1967 at the same time that Egyptian forces deployed into the Sinai. The IAF began to severely curtail flying activity so as to push up the availability of combat aircraft as close as possible to 100 percent.²⁵ In addition, IAF reconnaissance missions which had been regularly flown against the EAF for surveillance and tests of the air defense reaction times ceased the week before 5 June. On 4 June propellor-driven IAF aircraft were flown using jet aircraft communications procedures to help cover the maintenance stand-down. Just prior to the fifth the IAF launched several strong air patrols into the vicinity of the

Egyptian airbase at Hurghada on the Red Sea. They also provided some deceptive intelligence, that, together with the air activity, induced the EAF to deploy twelve MIG-21s and eight MIG-19s south to that airfield against a seeming IAF threat to the area, thus lessening the forces the IAF had to face in the north.

Preliminary Activities

The normal EAF ground alert began at 0200 on 5 June. The first fighter patrol of twelve MIG-21's was airborne at 0400 (dawn) flying a patrol orbit near the Israeli border. Other aircraft stood ground alert at the same time. Successive patrols were flown at thirty minute intervals in Mediterranean and Suez Canal area orbits with the last beginning at 0530 and probably recovering at about 0630-0645. These patrols were kept under surveillance by IAF radars. When the attack began, only four EAF trainers and Marshall Amen's IL-14 were airborne. The IAF also put up some flights of Magister jet trainers in order to convey the impression of a normal training day.

Penetration Routes, Profile and Timing

The first wave of forty aircraft apparently launched at varying times between 0710 - 0730.²⁷ General Hod indicated that flight routes were calculated to insure the utilization of all approach quadrants except the south (which could not be reached).²⁸ From a tactical targeting standpoint the ten target airfields were contained within a northeast/southwest ellipse measuring 170 X 60 nm. Published data indicates that initial IAF approaches and target area penetrations to the ellipse were made in the north/northwest and east/southeast directions, in effect, "sandwiching" the target array.

A postwar Israel Defense Force publication²⁹ contains a chart showing flight route details for the initial strikes. The chart indicates that aircraft targeted for the airfields in the Nile Delta and the west side of

the Suez Canal generally flew west from their IAF bases over the Mediterranean,³⁰ generally parallel to the Egyptian coast, and then ingressed over the north and northwest portions of the Nile Delta to attack their targets from the north, northwest and west. The aircraft targeted against the Sinai airfields flew south across the Negev Desert and then turned west to strike their targets from the south and southeast.

Aircraft in the first wave ingressed at very low altitudes (thirty-fifty feet) to stay below Egyptian radar and SAM coverage.³¹ Complete radio silence was maintained by all strike formations while inbound to target. Penetration speeds were reportedly 425-450 knots increasing as the formation approached the target area. TOT was officially given as 0745 for all airfields except the most distant, Beni Suef (0815) although a detailed strike description alleges that the first strike on Beni Suef also occurred at 0745. Apparently only the strike element attacking Fayid was delayed for a few minutes because of still uncleared morning ground mist at 0745. General Hod indicated that each flight was on target for seven minutes (although some open source material alleges up to eight to nine minutes, with a three minute "pad" allowed for navigation errors, or an extra pass over target). The time between attack waves is given as "ten minutes" or "less than ten minutes" in some publications but the twelve to nineteen minute figure given in Nadov Safran's book³² is probably closer to the truth; especially since it agrees with the most detailed published description of an individual strike mission³³ and an authoritative Egyptian report on activities surrounding the first attack on Cairo West.³⁴ In both cases the second wave struck fifteen minutes after the first.

After commencement of the first attacks at 0745 negated the need for further concealment, the following waves penetrated at higher altitudes to conserve fuel and descended to the deck only in the target area. The same timing sequence was repeated for each of the four waves that struck each airfield during the eighty minute initial strike (0745-0905).³⁵ Considering

all the available data, and utilizing General Hod's seven minute time-over-target and 15.5 minute average times between strikes, the overall timing of the initial strike appears as follows:

- (1) First wave - 0745:00 - 0753:30,
- (2) Second Wave - 0807:30 - 0814:30,
- (3) Third Wave - 0830:00 - 0837:00, and
- (4) Fourth Wave - 0852:30 - 0859:30.

After a ten to twenty minute "break" this attack sequence was repeated again from around 0915 to 1035. The first strike phase had apparently resulted in the destruction of all Sinai-based Egyptian fighters and this allowed diversion of a portion of the force to hit three further fighter bases in the Delta area during the latter part of the second strike phase. The timing of the attacks³⁶ against these fields suggests a maximum of two waves committed against them.

Delivery Tactics and Weapons

All aircraft were under a minimum-speed-over-target stricture of 450 knots according to General Hod. Aircraft climbed prior to target for a 45° dive-bombing attack against the airfield runways with weapons release at 2500 feet and pull-out at 1000 feet.³⁷ This was followed by three strafing passes with 30mm cannon against aircraft. The initial wave reportedly climbed early so as to register on EAF radars and catch formations of scrambling fighters taxiing toward runways. Eight groups of fighters and some bombers were caught in this manner.

The second wave Vautour strike on Beni Suef accelerated to 550 knots two minutes before TOT and made a high angle climb to 6-7,000 feet just before reaching the target. Some rocket attacks and skip-bombing against hangar-based aircraft³⁸ also occurred. According to General Weizman, relatively few bombs were delivered and these were basically intended only to damage the runways enough to prevent the launch of air defense reactors or the escape of grounded aircraft.

The IAF used 500 and 1000 lb. bombs against runways. They also apparently utilized a new low altitude drogued/rocket bomb (called the "dibber" in the open press). This represented the operational debut of the dibber although it was still not fully developed at the time. The dibber was used at least at Al Arish and Gebel Libni in the Sinai, and Amman Airport in Jordan where it created craters seven meters wide and one to two meters deep which required several hours to repair.³⁹

Aircraft strafing was done with the 1200 round per minute DEFA 30mm cannon which equipped all IAF combat aircraft. Mirage aircraft assigned to CAP carried MATRA R-530 air-to-air missiles in addition to their guns.

Opposition and Support Measures

Pilots reported heavy AAA which accounted for most IAF losses and many indiscriminate SAM launches. Some EAF interceptors were encountered and most were shot down with few IAF losses. One EAF failure was the general lack of fighter reaction from the bases that were not attacked in the initial wave. This failure was probably due to the disruptive effect of the attack on EAF C², exactly as it had been estimated by the Israelis. The disruption was compounded by the absence of command authority caused by the fact that the commander of the Egyptian Air Force was trapped in the air aboard Marshall Amen's aircraft until the beginning of the second round of air strikes. The paralysis caused by the rigidity of the EAF C² structure was demonstrated at Cairo West where a Soviet advisor to the EAF ordered some EAF pilots to fly three SU-7s that were still intact after the first IAF strike wave to safety.⁴⁰ The pilots refused, saying that they had no orders, and fifteen minutes later the second IAF wave destroyed the aircraft.

The Israelis further added to the confusion by employing radio-electronic warfare measures in support of the initial strikes. This reportedly included jamming of EW/GCI, SAM and AAA radars as well as Egyptian/Syrian/Jordanian inter-country radio communications and, probably, some air defense C² networks. There are also some reports of deceptive measures being carried out by Arab-speaking IAF pilots.

Battle Management and Strike Reporting

After the initial wave, the IAF was able to redirect airborne strike elements and refine time-urgent targets. In some cases, CAP aircraft were also directed to strike specific ground targets at the airfields. In addition to specially designated reconnaissance-trained crews in each combat squadron, the IAF also employed a simple technique for real-time damage assessment. IAF pilots were provided with albums of airfield photographs with coded grid overlays.⁴² Strike results were reported directly to the IAF Command Post during egress. This supported quick damage assessment and re-evaluation of target priorities. In a few instances, the system apparently broke down because of communications problems. This resulted in several follow-on strikes being sent to airfields that had no remaining aircraft targets.

Results of the Initial Wave

By the end of the first strike the IAF claimed 189 EAF aircraft destroyed on the ground and eight MIG-21's in the air. The results of the second wave were a further 107 EAF aircraft destroyed.⁴³ The first strike is also reported to have made six airfields inoperable. Several EW/GCI radars and possibly some SAM radars were also struck as targets of opportunity.

Subsequent Airfield Attacks on 5 June

After recovery of the second strike wave the IAF paused for about an hour to assess the situation and effect repairs since, reportedly, a significant number of strike aircraft sustained some battle damage from AAA. Apparently only defensive fighter patrols were flown during this time. At about 1130 an air strike was launched by two Vautours against Luxor airfield. Israeli intelligence had determined that eight TU-16s had escaped from the northern bases and landed at Luxor. The Vautours struck

the base at 1230, and in four minutes of strafing allegedly destroyed all eight TU-16s plus eight other aircraft. Air strikes were also launched against Bilbeis near Cairo and Hurghada on the Red Sea and these were hit at 1200 and 1215 respectively. A number of other EAF bases were targeted for this time period but these missions (at least eight) were scrubbed while preparing for takeoff or in flight. These aircraft were diverted to attack Syria and Jordan.

Some time between 1130 and 1200 a dozen Syrian Air Force MIG-21s made some hit-and-run raids over northern Israel. At about the same time 16 Jordanian Air Force Hunters attacked an IAF transport base, Kfar Sirkin, destroying one Noratlas transport. A second attack struck the airfield at Megiddo which had been set up as a decoy for Ramat David. Megiddo lies four miles to the southeast of Ramat David and has the same runway pattern and orientation.

The diverted IAF strike formations, along with some others, attacked the two main Jordanian air bases, Amman and Mafraq, at 1245 and 1300 respectively. These attacks destroyed most of the Jordanian Air Force including twenty-one Hunters (at least seventeen on the ground⁴⁵, one in the air, and two destroyed by attempting to land on bombed runways), six transports, and two helicopters. As in the EAF attacks, the aircraft came in successive waves. Because of the shorter range the IAF aircraft groups reportedly spent up to twenty minutes over the target area (the extra time over target also occurred at some Syrian airfields).⁴⁶ The Marconi 547 radar-equipped EW/GCI site at Aijun was also hit.⁴⁷

Between 1300 and 1315 four Syrian airfields were hit, with a fifth attack beginning at 1545 by at least two waves of Mirages. A total of fifty-three aircraft, nearly half of the Syrian Air Force, was destroyed on the ground and in the air. One Iraqi airfield, H-3, was hit by three Vautours at 1500. Six MIG-21s from an Iraq fighter squadron and three Jordanian Hunters that had escaped destruction in Jordan were reportedly destroyed by this small attack.⁴⁸

In spite of the attacks on Syria, Jordan, and Iraq, the IAF effort against airfields was reduced in the early afternoon as some first-line

aircraft joined the Magister jet trainers in supporting the ground forces. The IAF did resume strikes on EAF bases and radar installations (upgraded to a primary target) later in the afternoon including seeding the airfields with delayed action bombs to hinder repair efforts. Intelligence concerning the concentration of some surviving SU-7, MIG-19 and MIG-15/17 aircraft at Cairo International Airport led to a Mirage strike there at 1715 against only military aircraft.⁴⁹ Vautours also struck Ras Banas at 1800 in the longest range air strike of the war (435 nm). Some Egyptian SAM sites were also struck in the afternoon.

Results of Day 1 strikes

The IAF attacked a total of twenty-six different airfields on 5 June. Sequential TOTs are provided in Appendix F, Table 6. At the end of the first day the IAF announced the destruction of 387 Arab aircraft broken down as follows:

EAF	300 (including 20 air-to-air)
Syria	52
Jordan	20
Iraq	<u>15</u>
	387

On 7 June, General Hod revised the first day figure upward to 410. The IAF lost nineteen aircraft on the first day (two Mirages, four Super-Mysteres, four Mystere IVs, one Vautour, four Ouragans and four Magisters); nine in Egypt and ten in Syria. Two or three of these were the result of aerial engagements and the rest attributed to AAA. The Arabs lost thirty-eight aircraft on Day 1 in thirty-four encounters with the IAF of which twenty-six were EAF aircraft (eighteen encounters). A number of airfields were temporarily inoperable from runway damage but damage to airfield facilities was apparently minimal in many cases.⁵⁰

Day 2-6 Operations

The IAF allegedly made some night airfield attacks using flares to assist target location, but neither the targets nor the results are available. The Israelis struck H-3 in Iraq again on the morning of 6 June after an ineffective attack against Israeli targets by an Iraqi TU-16.⁵¹ The attack, by a mixed formation of eight Mirages and Vautours, took place at 0500 and was intercepted by Jordanian-manned Iraqi Hunters. The reactors shot down three IAF aircraft and lost several of their own. After the TU-16 raid and the Israeli counterstrike there were no further Iraqi air operations against Israel. The IAF also continued occasional air strikes against Egyptian and other airfields. Apparently thirteen of the nineteen Arab aircraft lost on Day 2 were shot down in air-to-air combat. Some disparity in totals remained. A breakdown of preliminary IAF figures totaling 416 is as follows:

	<u>Egypt</u>	<u>Syria</u>	<u>Jordan</u>	<u>Iraq</u>	<u>Lebanon</u>
TU-16	30	-	-	1	-
IL-28	27	2	-	-	-
MIG-21	95	32	-	9	-
MIG-19	20	-	-	-	-
MIG 15/17	82	23	-	-	-
SU-7	10	-	-	-	-
Hunter	-	-	21	5	1
Transports	32	-	6	2	-
Helicopters	<u>13</u>	<u>3</u>	<u>2</u>	<u>-</u>	<u>-</u>
Total	309	60	29	17	1 = 416 ⁵²

Of these, 393 were reportedly destroyed on the ground. The total figure was later upgraded to 429 but this table gives a good idea of the approximate degree of force destruction at that point. The IAF losses apparently totalled twenty-six at the end of Day 2.

On Wednesday (Day 3) the IAF attacked at least five SA-2 sites in the Suez Canal area apparently to assist its support of ground forces in the Sinai. The attacks were made against the FANSONG radars using a low-level approach with a pop-up maneuver to deliver 1000 lb. bombs in a dive. The Arabs lost fourteen aircraft on Day 3. The last IAF airfield attacks apparently took place on Day 4 against Syrian airfields in the general vicinity of the Golan Heights and Tiyas (T-4). A further nine Arab aircraft were apparently lost from Day 4 to the end of the war.

Results of the War

Aircraft - Analysis of all sources indicates that 444 to 452 Arab aircraft were destroyed. General Hod told a Hq USAF meeting in January 1968 that 393 aircraft were destroyed on the ground and fifty-one in air-to-air combat, a total of 444.⁵³ Later open source analyses use the figure 452 and break it down by aircraft type (see Table 7). In *The Third Arab-Israeli War* published in 1972, Edgar O'Ballance states that "the final Israeli claim" was that seventy-nine aircraft were brought down in aerial combat and he provides details of encounters and aircraft lost by dates and forces. Notwithstanding the disparity in the way in which twenty to twenty-eight Arab aircraft were lost, the fact that ninety percent of them were lost on the first day (including about half the EAF, Syrian and Jordanian combat aircraft) effectively established Israeli air superiority and decided the outcome of the war by lowering the collective Arab air force capabilities to the level of sporadic harassment.

According to General Hod, the IAF lost forty aircraft in combat, but that probably includes the Magister jet trainers. Available evidence indicates that from eight to twelve of the forty were lost in aerial engagements⁵⁴ and the rest to AAA and ground fire. The IAF may also have lost some aircraft in non-operational accidents. The effectiveness of the airfield attacks is obvious; for a loss of some thirty aircraft directly involved in attacks the Israelis destroyed nearly 400 Arab aircraft.

Air Defenses - The IAF destroyed a total of eight SA-2 SAM sites and from eighteen to twenty-three radar stations during the war. The SA-2s were ineffective during this conflict but AAA took the most significant toll of the IAF (although not enough to prevent them from carrying out their mission).

Airfields - Aircraft and runways were the primary targets on the Arab airfields and the goal of these attacks was to preclude timely reaction and to destroy aircraft. The IAF succeeded in pinning down the EAF at the critical time on 5 June. Most aircraft except the large ones were essentially unprotected, although many were widely dispersed except for clusters of alert or scrambling aircraft near the ends of runways. That the EAF was not completely suppressed and its airfields totally inoperable was shown by the continued, albeit small and sporadic, opposition to IAF operations and attacks on Israeli ground forces. The EAF encountered and fought IAF aircraft twenty-six times from Day 2 to Day 6 (as opposed to eighteen dogfights on Day 1). On Day 4 the EAF was still able to fly thirty-two sorties in about ten hours against a small Israeli column moving westward across the northern Sinai toward the Canal.⁵⁵ Generally, damage to airfield facilities was minimal, but effective Arab air force operations were precluded by extremely heavy losses of operational aircraft. In addition to attacks on airfields, the Egyptians also lost the airfields in the Sinai Peninsula which Israel captured and occupied.

Operations

An article in the January 1977 *Armies and Weapons* quotes an Israeli provided aircraft loss rate in the 1967 war of 1.9 per 100. Based on the loss of forty aircraft, that works out to 2,105 total sorties for the war. General Hod indicated that thirty percent of the total sorties (632) were for airfield attack and air superiority, presumably leaving the rest (1454) for interdiction and close support. General S.L.A. Marshall indicates that 492 IAF sorties were used to kill 402 Arab aircraft on the ground⁵⁶ (apparently presuming the accuracy of the air-to-air kill figure given by General Hod and using the higher total estimate - 452). This would leave

140 sorties or seventy two-aircraft elements (which is the way CAP missions were normally flown) for the air superiority function. Given the 492 sortie figure as being a correctly quoted figure (and not a percentage/ratio of some other total such as sortie to aircraft destroyed) then attack sortie/aircraft kill rate is as follows depending on the real total of aircraft destroyed:

<u>Aircraft Destroyed</u>	Sortie to Kill <u>Ratio</u>
365-373 (Edgar O'Ballance, 1972)	1.32 - 1.35
393 (General Hod, January 1958)	1.25
402 (General S.L.A. Marshall, 1967)	1.22

Average = 1.268 attack sorties flown per aircraft destroyed on the ground.

The almost shocking success of the Israeli attacks may have forever changed the requirements of airfield attack planning. In the immediate aftermath of the war many air forces initiated major airbase hardening and aircraft shelter programs. The Israelis proved beyond any scintilla of doubt the value and impact of detailed preplanning and surprise.

LESSONS FROM THE BATTLE

By 1967, the Egyptians under the sometimes resented guidance of their Soviet mentors, had attempted to remedy many of the military defects that had caused them to lose the previous war. By conventional standards they were in much better shape. They had a larger, better organized and better equipped air force, and training had reached a higher standard. They had built a somewhat better airbase structure with what appeared to be a reasonably safe degree of dispersal. Conventional revetments for their most valuable aircraft, the TU-16, were in use. Unfortunately, the airfield locations were still tied, for the most part, to the original RAF siting, concentrated in the Canal Zone and the southeast quadrant of the Nile Delta and not well positioned to provide peripheral defense against the multi-quadrant attack that the IAF conducted on 5 June.

Despite the Arab improvements, the Israeli attack was wildly successful. The most important factor was Israeli preplanning:

"...as forces were developed, equipped and trained, the plan was rehearsed and advanced. The overall plan required very few minor changes; it was carried almost ninety-five percent as planned -" 12 January 1968 meeting with General Hod.

OBSERVATIONS

Planning and Preparation

- It is apparent from external details of the plan that it could have been redirected without significant impact on the overall goal.
- Counter air planning included full scale campaign planning concurrent with continual modification and update.
- Timing for the attack exploited known Egyptian procedures, knowledge of which had been gained through SIGINT. The dawn patrol period was avoided and the attack unfolded at a time when command and control was most likely to be disrupted by shift changes in the command structure, and after initial air defense flights of the day had been terminated.
- Intelligence collection was sharply focused toward support of offensive counter air.
- Pilots were continually provided with updated photography and other information on their assigned targets.
- Pilots conducted frequent rehearsals on live ordnance ranges which simulated Arab airfields. Intensive ground training concentrated on turnaround time reduction.
- Covert preparation of the attack force brought force availability to near 100 percent OR.
- Flights by trainers simulated normal levels of activity during both preparation and on the morning of the attack.
- Feints by Israeli aircraft induced the Egyptians to divert fighter forces to remote bases thus reducing their concentration of strength.

Attack Phasing

- Attack phasing demonstrated several factors:
 1. The Israeli aircraft launch rate was not optimized for shock effect at airfields but none the less represented the optimum choice of weapons effect, survivability and continuous effect on the target.
 2. Little concern for enroute attrition -Israeli planners saw no need to overwhelm enroute ground defenses with mass gaggles. CAP was provided in planning but appeared to be limited.
 3. Each target in the initial raids was attacked by sixteen aircraft operating in successive four-ship elements. Time over target for the initial set of attacks spanned some seventy-five minutes.
 4. Attack planning included a conservative approach to force commitment and guaranteed flexibility. The plan appears to have had a great potential for "fall-back positions," although in the actual event it probably unfolded with great precision.
 5. Realtime BDA, for which the Israeli pilots had been specially trained, allowed rapid redirection of subsequent attacks.
 6. Sequential phasing of attacks ensured that the attack groups could be turned with efficiency upon return from their missions. No large group of aircraft was ever cocked on the runway waiting to go or lined up on taxiways awaiting entrance to ramps.

Targeting

- The plan showed a clear system of target prioritization.
- Prime targets were late model FISHBED fighters and bombers capable of attacking Israel.

- The only diversion from the number one priorities were forward airfields which were also attacked early to prevent the launch of defensive sorties which could have disrupted the raid timing or mounted offensive sorties against IAF homebases.
- The main goal of the attacks were aircraft in the open. Initial attacks used a critically timed pop-up tactic on ingress to lead the Egyptians to scramble the strip alert aircraft. This tactic increased the chances that aircraft would be taxiing on ramps and runways.
- The target selection ensured that the EAF sortie delivery capacity was immediately affected. The affect of the air attacks was remedied rapidly in the postwar period when the Soviets resupplied the Arabs with aircraft, but the immediate war objective was deliverable sorties and these were precluded.

From their experience in the 1956 war, the Israelis had understood very well the requirement for control of the air. To enable this they had a clearly defined initial objective, the destruction of the EAF, to which their resources, planning, training, and intelligence collection was geared. The latter was of prime importance in taking maximum tactical advantage of the EAF's mode of operation and weakness in command and control and basing. They formulated an attack plan predicated on surprise. Target selection and overall planning show a near perfect understanding of both the operational situation and the development of offensive counter air tactics.

One lesson of the airfield attacks in 1967, the vulnerability of aircraft on the ground, was a world-wide one since even the combat aircraft of the major powers were unsheltered at the time. Additionally, the need for sustained airfield operation in a combat environment was made clear and would result in the construction of additional runways at many airbases and the apparent institution of runway repair procedures to compound the difficulty of delivery tactic selection and force allocation.

SECTION 10

THE YOM KIPPUR WAR, OCTOBER 1973

The Yom Kippur War demonstrated that the Egyptians and Syrians (and their Russian advisors) had learned the airfield attack lessons that the IAF had taught them six years before. Unfortunately, their lack of air combat and air-ground attack capabilities would still cost them heavily and the Israelis would, in the end, make up for their lack of success against protected Arab aircraft on airfields by dominating the air battle through superior air-to-air combat and efficient ground defenses. In addition, Arab air defense coordination difficulties would cause a significant number of their aircraft (almost fifty) to fall victim to their own defenses. The ultimate Israeli success does not alter the fact that the airfield attack problem (for the offense) was raised by an order of magnitude because of the reaction to the success of the techniques applied in the 1967 conflict.

EGYPTIAN AIRFIELDS

After the 1967 war the EAF immediately embarked on a program to solve their survivability problem. The program had three major facets:

- (1) The building of additional dispersal airfields, highway airstrips and additional runways at current airfields and the extension of some current short runways¹ to increase survivability through an expanded target set;
- (2) The construction of hardened aircraft shelters (or hangarettes) to protect aircraft from attack;
- (3) The expansion of the air defense radar, SAM, and AAA networks into a separate Army subordinate, EAF-commanded element.

Between 1967 and 1973 at least thirteen additional jet-capable airfields were constructed in Egypt. In addition, from one to three new runways (some parallel to previously built main runways) were built or extended at seven existing airfields. These are listed in Appendix G, Table 1 and their number-keyed locations are shown in Appendix G, Figures 1

and 2. At least five highway strips were also prepared by mid-1968. This airfield expansion made up for the loss of the four Sinai airfields and the presumed vulnerability of some Canal Zone airfields to Israeli artillery. Additionally, this new construction provided fighter bases for defense in areas through which IAF strike aircraft had been routed in the devastating 5 June 1967 attacks on the EAF.

Construction of one- and two-aircraft (single and double bay) hangarettess was reported as early as December 1967 at Quweisna, north of Cairo. These hangarettess were of Soviet design,² and were similar to those under construction in the Warsaw Pact countries. A total of 450 of these hangarettess were reportedly built in Egypt. Reconnaissance photographs released by the IAF in May 1970 reflected detailed Israeli awareness of the extent of the program and cognizance of its significance. Some of these photos showed attempts to camouflage selected hangarettess. The hangarettess were credited with providing a 95 percent probability of attack survival.³

EGYPTIAN AIR FORCE/AIR DEFENSE STRENGTH

After the 1967 war the EAF was partially re-equipped by the Soviets. Major additional deliveries were not forthcoming until the 1969-1970 War of Attrition. By the time of the 1973 war the EAF order-of-battle was approximately as follows:

TU-16	25 equipped with Soviet AS-5 KELT ASM's
IL-28	5-10
MIG-21	200-220
MIG-17	150-200
SU-20	"a few"
SU-7	80-120

The Air Defense Command, following the then-current Soviet pattern, was an integrated, radar-controlled and directed independent force consisting of nine MIG-21 squadrons, 50 to 60 SA-2 SAM sites, 65 to 75 SA-3

SAM sites, 40 SA-6 mobile SAM sites, several thousand AAA guns of all sizes from 14.5 to 100mm, along with ZSU 57-2 and ZSU 23/23-4 mobile tracked AAA systems. The following types and numbers of AAA weapons were reportedly available to the Egyptians:⁴

ZPU(14.5mm)	250
Cannon (20mm)	800
ZSU-23-4 (23mm)	125
S-60 (57mm)	100
ZSU-57-2 (57mm)	?
KS-12 (85mm)	?
KS-19 (100mm)	300

The tracked mobile AAA vehicles, although defending the ground force units, were apparently integrated into the SAM barrier which the Egyptians deployed to the Suez Canal area to defend their bridgehead in the Sinai. This air defense system was reportedly fed by 180 radar sites⁵ and controlled by 50 hardened control centers at various echelons.

SYRIAN AIRFIELDS

Like the Egyptians, the Syrian Air Force also expanded its airfield network after the 1967 war. Five new airfields were built, one was extended to become jet-capable and additional runways were added to four others. A total of sixteen Syrian jet-capable airfields were available when the 1973 war began. The Syrians also constructed one- and two-aircraft hanglettes to protect their aircraft. Syrian airfields are listed in Appendix G, Table 2 and shown in Appendix G, Figure 3.

SYRIAN AIR FORCE/AIR DEFENSE STRENGTH

The Syrian Air Force was re-equipped and expanded after the 1967 war. By 1973, Syria fielded a little over 300 combat aircraft including about 200 MIG-21s, 30 to 45 SU-7s, 80 MIG-17s, and a few SU-20 advanced fighter-bombers. Syria also had 25 to 30 SA-2 and SA-3 SAM batteries and 12 to 15

equipped with the SA-6. In addition at least 27 AAA companies were in service with the ground forces. AAA equipment in service with the Syrians included the following:

ZPU	158
ZU-23	158
ZSU-23-4	96
M39 (37mm)	12
S-60	72
ZSU-57-2	36
KS-12	72
KS-19	180
KS-30 (130mm)	84

ISRAELI AIRFIELDS

With the capture of the Sinai Peninsula in 1967 the IAF gained the use of four EAF jet-capable airfields. They also constructed two additional airfields, one of which, Ras Nasrani, was at the southern tip of the Sinai Peninsula. At the time of the 1973 war the IAF had a significantly expanded total of eleven jet-capable airfields (listed in Appendix G, Table 3, and shown on Figure 4).

ISRAELI AIR FORCE/AIR DEFENSE STRENGTH

The French-imposed embargo after the 1967 war forced the IAF to begin to re-equip with American aircraft, primarily F-4s and A-4s. IAF strength in October 1973 was as follows:

F-4E	127-132
A-4E/H	162-170
Mirage III	35
Barak (modified Mirage III)	25
Super Mystere	12-18

Mystere IV A	23*
Vautour	10-12**
Duragan	<u>30</u>
Total	424-445 combat aircraft.

*Identified as in reserve although up to 6 were lost in the conflict.

**Identified as being in storage.

The Israelis also had 10 to 12 SAM batteries with 60 to 75 HAWK launchers and 20, 30 and 40mm AAA guns.

BACKGROUND

Subsequent to the 1967 war, Egyptian, Syrian and Israeli forces engaged in a constant series of skirmishes and border-area attacks and retaliation that would continue until the 1973 war. This sporadic fighting escalated through incidents such as the sinking of the Israeli destroyer Eilat and the retaliatory destruction of Egyptian port and refinery facilities in the area of the Suez Canal by artillery barrages, and through IAF strikes, and commando raids on other Egyptian targets. In March 1969, Nasser formally abrogated the ceasefire and in June declared a "War of Attrition."

In July 1969, the IAF began massive air attacks on Egyptian air defense targets. By December of that year the IAF had destroyed 24 SA-2 sites and 67 EAF aircraft (representing one third of EAF combat aircraft and all of the Canal Zone SAM defenses). In January 1970 the IAF received radar warning receivers (to detect SA-2 FANSONG radar lock-on)⁶ for its newly acquired F-4s. An intensive series of air strikes against Egyptian targets began on January 7 with an attack on three military airfields near Cairo. By the end of April the IAF had flown 3,300 sorties and delivered 8,000 tons of ordnance.⁷ Four-fifths of Egypt's air defense capability was gone by that time. By June 1970, the IAF had shot down 101 EAF aircraft (and 23 Syrian planes) for the loss of 20 aircraft of its own.

During the first half of 1970 the Soviets deployed a new air defense network into Egypt to defend against the Israeli raids and to attempt to

alter the balance between Egypt and Israel. This network eventually included "improved" SA-2s (at least 12 sites), SA-3 SAMs for the first time outside the Warsaw Pact (eventually 75-85 sites), ZSU-23-4 AAA, and 150 FISHBED J interceptors at six bases.⁸ Soviet personnel manned the fighters and SA-3s, and probably the air defense command and control structure as well.

Twelve improved SA-2 batteries and two or three SA-3 batteries began deploying forward toward the Suez Canal on the night of 29/30 June. After two IAF F-4s were ambushed and shot down, the IAF attacked the new complex and destroyed eight SA-2 batteries for the loss of three more F-4s and two A-4s. Some SA-3s were fired during this activity along with SA-2s using improved computer controls (ripple-fired batteries in an integrated timing sequence to compound the aircraft survivability problem). This loss rate would have been unacceptable to the IAF over the long run since the SAM batteries were being quickly repaired and remanned, although arguments concerning a learning curve against the new equipment and eventual reduction of losses may be valid.

In any case, a number of events throughout the summer combined to end Israeli operations:

- (1) Soviet-manned FISHBEDs attacked Israeli A-4s enroute to targets in the Nile delta;
- (2) Israeli fighters ambushed and shot down four Soviet-piloted FISHBED Js;
- (3) Rising international tensions contributed to reinstitution of the ceasefire in early September; and,
- (4) In conjunction with final negotiations, the Soviets and Egyptians deployed a large (ninety site) SAM barrier in a semi-clandestine fashion to the immediate Canal area.

In hindsight, the air defense operations and tactics introduced by the Soviets for a short time in mid-1970 were a preview of the problems the IAF would face in the 1973 war, namely an integrated air defense network based primarily on a "wall" of interlocking SAM and AAA fire with advanced equipment.

THE BEGINNING OF THE WAR

The first IAF decision regarding a preemptive air strike came on Friday 5 October 1973. The IAF had run increasingly frequent reconnaissance missions, apparently on its own initiative, since mid-September. Because of the character of the data concerning the build-up of equipment by 3 October, the IAF made an intensive reconnaissance effort late on the 4th. Photo analysis on Thursday night convinced the IAF intelligence analysts that war was imminent. General Peled, the IAF commander, had already placed the Air Force on alert and at 1400 on Friday, 5 October, asked the Israeli Chief of Staff for permission to launch a preemptive air strike against the Arab airfields that day. The Chief of Staff refused (apparently swayed by faulty military intelligence estimates that would later be a source of investigation and recriminations among the Israeli government), but did allow him to prepare for a strike on 6 October.⁹ The receipt of further hard evidence prompted an appeal by the Chief of Staff early on 6 October for an air strike. The premier, Mrs. Meir, decided against it for three reasons:

- (1) It was politically unacceptable for the Israelis to strike first at this point in time;¹⁰
- (2) The EAF was protected by hangarettes which would negate the possibility of irreparable damage such as that caused by the 1967 attack;
- (3) A first strike against the assembled armor and artillery might disrupt preparations for a few hours but would not deter the attack.¹¹

Additionally, because the pilots would be attacking forces already on alert and protected by an intense missile screen, the IAF might suffer losses that would affect its offensive air capability for the rest of the war for an uncertain gain. This last point, made by General Dayan, suggests that the Israelis were already cognizant of some of the problems they would face in conducting air strikes against targets defended by the Arab air defense systems.

EGYPTIAN AIRFIELD ATTACKS

The initial airfield attacks of the 1973 war were made by the EAF. The Egyptians claimed that some 220 aircraft¹² participated in the first strike at 1400 on 6 October. Their targets, according to a map published by the Egyptians, included the following Sinai airfields:

- (1) Al Arish,
- (2) Bir Hamma,
- (3) Bir Hasanah New (also called Bir Thamada),
- (4) Bir Gifgafa (called Rифидим by the IAF),
- (5) Gebel Libni, and
- (6) Ras Nasrani.¹³

Two small fields at Baluza and El Tur were also attacked. Other targets included HAWK SAM sites, three Israeli command posts, radar sites, 175mm artillery positions, ECM installations, armored force garrisons, and logistics installations. The Egyptians claim to have caused runway damage at Bir Gifgafa and Bir Hasanah as well as every other forward airfield in the Sinai and state that these airfields stayed inoperative for the first 48 hours of the war.

It appears that some damage was caused, but it is unlikely that the latter claim is true. Israeli General Adan, commander of a division in the Sinai, indicated that it was surprising how ineffective the EAF strike actually was. He indicated that Bir Gifgafa was slightly damaged but still usable, but that Bir Hasanah airfield, which was not in use by the IAF, was heavily damaged.

EAF gun camera films show the attack at Ras Nasrani and explosions on the taxiways. They also show two Mirage fighters becoming airborne. Israeli General Herzog claims that at 1330 General Peled ordered IAF aircraft to begin flying patrols and that two minutes after two Israeli aircraft had taken off from Ras Nasrani, twelve EAF aircraft attacked the airfield.¹⁵ He also indicates that seven of the attacking aircraft were shot down by the two fighters that had scrambled (this is possible since eleven EAF aircraft were lost the first day).¹⁶ General Adan claims the EAF

losses induced them to cancel a second strike¹⁷ although the Egyptians claim that the cancellation was due to successful results on the first strike.

On 8 October, the EAF struck Bir Hasanah again at 0900 and claimed the destruction of some helicopters. Radar and HAWK sites were also allegedly attacked.¹⁸ No further references to EAF attacks on Israeli airfields can be found, although some sporadic attacks on other Sinai installations did occur, as did the launching by TU-16s of some twenty-five AS-5 KELT air-to-surface missiles (most of which were shot down), against various targets. Only three targets were hit by KELT's, two radar sites and a supply dump.

About forty percent of EAF attack sorties were flown in the first three days. None were flown on the fourth and only an average of forty-four a day up until 21 October when 160 sorties were flown in a special effort to help the nearly trapped Third Army at Suez. The sortie rate then declined until the end of the war.

ISRAELI AIRFIELD ATTACKS IN EGYPT

The initial IAF attacks on three EAF airfields occurred in the early morning of 7 October. A number of runways were hit but the IAF lost ten aircraft penetrating Egyptian defenses. These attacks were apparently part of a major IAF attack on Egyptian targets (planned the previous night) in an attempt to begin the breakdown of the Egyptian SAM barrier.

Just after the first sortie was launched at 0700, the IAF was ordered to redirect its efforts to the critical situation on the Golan Heights. General Adan stated that the air attacks against Egypt were reduced that day because of the required redirection and not because of early IAF losses.¹⁹

On 8 and 9 October, the IAF flew its most intensive attacks against Egypt, a total of 859 sorties in two days. On the eighth, airfields and other targets as far west as Cairo were struck. The airfields at El Mansura, Wadi Al Jandali, and apparently Quweisna, were targets on the ninth. The EAF lost forty-eight aircraft on the eighth and eleven more on the ninth, probably most of the former, and all of the latter number, in air-to-air combat. The SAMs were also struck on the ninth.

The IAF effort against Egypt was reduced on the tenth as the war against Syria intensified. The airfields at Az Zaqqaziq and Quweisna were hit along with SAM sites. An early warning radar station at Baltim was also hit.

This was the first of a series of IAF raids against coastal radar stations on both the Mediterranean and the Red Sea. It is likely that these attacks may have allowed undetected IAF penetrations similar to those in the 1967 war to strike airfields and other targets from unexpected quadrants. Interestingly enough, attacks on 9, 10, and 12 October against the five SAM sites protecting Port Said, together with a series of persistent attacks on nine SAM sites in the Quantara area, twenty-five miles to the south, would leave the whole area undefended by 14 October, reducing North Egypt air defenses even more.

No IAF aircraft were lost on the tenth in the south (as opposed to thirty-four on the previous four days). IAF losses dropped dramatically in the south after 9 October with subsequent losses totaling only fourteen for the rest of the war even though seventy-five percent of the attack sorties against the Egyptians (over 4,000) were flown during this time period. This was due to the effects of an IAF learning curve with respect to Arab air defenses which resulted in improved aircraft tactics after 11 October. These improvements included evasive maneuvers and special flight planning. Greater availability and use of ECM aids including jammers and chaff also occurred after 11 October.²¹

Attacks against Nile Delta airfields (El Mansura, Wadi Al Jandali, and Zalahia) continued on the eleventh, albeit at a reduced scale--only fifty-five attack sorties were flown in that theater. EAF air defense reactions and losses were correspondingly light. IAF attacks against airfields may have occurred from 12 to 13 October but they were not reported. On the fourteenth however, IAF activity in the south began to increase after a three day lull coincident with heavy ground combat activity and a reduction of attack operations against Syria. The EAF reported attacks on airfields in the Delta by sixty IAF aircraft.

On the fifteenth, the IAF continued a higher attack sortie rate and struck the following airfields: Al Salihiyah, Birma, El Mansura, and Wadi

Al Jandali. Destruction of at least four and possibly seven SAM sites by artillery on the east bank of the Suez Canal, in conjunction with the Israeli Army crossing of the canal that night, opened up a small safe air space into which the IAF could penetrate to begin providing close air support. On the sixteenth, the ground forces on the west bank of the Canal began to expand their bridgehead, systematically destroying Egyptian SAM sites and expanding the envelope of safe air space in which the IAF could operate. Eventually, forty-four of sixty-two SAM sites in the forward Canal/Sinai area would be destroyed.²²

In spite of the Egyptian Air Force's apparent proclivity to avoid attrition through air combat by remaining in its hangarmettes (from 11 to 15 October the EAF lost only twenty-five aircraft in contrast to its loss of eighty-three in the first five days of the war) it began to react to the potentially serious Israeli bridgehead on the afternoon of the sixteenth.

Ninety attack sorties and an increased number of air defense sorties were flown that day with the corresponding loss of 15 aircraft (as opposed to 2 for the IAF). IAF sorties reached the highest total in a week, 292 sorties, and coastal radar stations at Baltim, Damietta, and Qattaniyah were struck.

The attacks on three adjacent radar sites on the coast suggested even more strongly that the IAF was planning penetrations on the flank of the missile screen. Aside from an attack on the small airfield near Port Said on 10 October, no further IAF airfield attacks are reflected in open source data. However, the EAF increased its offensive and defensive sortie rate from that point on to the end of the war and lost 131 more aircraft in the process. IAF attack sorties continued to increase, reaching a high point of 550 on 22 October just before the first cease fire. EAF airfields struck during the war and the number of major raids on each (if known) are as follows:²³

<u>Airfield</u>	<u>No. of Raids</u>
Al Manzilah	
Az Zaquaziq	
Beni Suef	1
Birma	4
Cairo International	

Cairo West	
El Mansura	4
Quweisna	1
Wadi Abu Rish	1
Wadi Al Jandali	3
Zalahia (As Salihiyah)	3

ISRAELI AIRFIELD ATTACKS IN SYRIA

After initial counter-SAM strikes on 7 October, the IAF made its first attacks on Syrian airfields on the eighth. Five airfields were hit: An Nasiriyah, Dumayr, Kholkhole, Marj Ruhayyil and Sayqal. SAM and radar sites were also hit. The IAF lost four aircraft on the Syrian front and Arab losses totaled nineteen. Of those, between four and six were reportedly Iraqi MIGs that had begun operating that day on the Golan front and were promptly shot down by Syrian SA-6s because of IFF coordination problems (this problem plagued the Arabs for the entire war and accounted for a total of forty-eight aircraft).

On Tuesday the ninth, IAF F-4s attacked both the Syrian General Staff and the Syrian Air Force Headquarters in Damascus. The former was partially destroyed and the latter heavily damaged. One report indicated that a major Syrian air defense C2 installation was destroyed on the ninth,²⁴ and this may have been located at the Air Force Headquarters.

Sustained attacks continued against SAM sites, and two IAF Phantoms destroyed a radar station at Jebal al Baruk in Lebanon which the Israelis claimed was feeding information to the Syrians.²⁵ IAF losses in the north totaled six and the Syrians lost nine.

The IAF resumed attacks on airfields on 10 October, striking (for the first time) Aleppo and the runways at Damascus International Airport²⁶ which had been closed to commercial traffic and was being utilized by MIG-21s, SU-7s, and the new SU-20s.²⁷ SU-7s and some other aircraft were hit on this raid. The airfields at Kholkhole and Marj Ruhayyil were also attacked. Attacks continued on Syrian SAM sites, some of which had reportedly been pulled out of the Golan area on the ninth to bolster the

Damascus area after IAF attacks²⁸ and because of a "near exhaustion of missiles" due to a high expenditure rate during the first days of the war.²⁹

The IAF also began a program of attacks on industrial and other military targets, including an oil refinery, an electric power station at Homs, several ports, and Syrian Navy Headquarters at Minat al Bayda. Large-scale air battles were fought with Syrian aircraft attempting to penetrate the IAF fighter screen. The loss figures for the tenth reflect this with twenty-nine Syrian aircraft down as opposed to three Israeli.³⁰

On 11 October, the IAF made a concentrated attack on eight Syrian airfields³¹ to prevent Syrian Air Force reaction to an Israeli ground offensive on the Golan Heights. The target set represented virtually every significant air base in southwest Syria and within 120nm of the front line. The significance of the attack was reflected in the highest IAF daily attack sortie total for the Syrian campaign, 363, and in the dramatic drop in Syrian Air Force attack sorties on that day from an average of 132 attack sorties a day between 6 and 10 October to the lowest total observed up to that time, 24.

The character of the attack and the results reflected in the sorties make it obvious that the IAF attacked runways and taxiways, probably continuously, during the day to prevent Syrian Air Force flight operations. IAF losses total eight for the day and the Syrians lost seven aircraft. The IAF was also assisted by the breaching of Syrian lines by the Israeli Army on 11 October, forcing the Syrians to pull back part of their SAM/AAA force.

On the twelfth, Syrian airfields were attacked again by the IAF along with SAM sites and other military targets in an effort (209 sorties) significantly reduced from the previous day. The Syrian Air Force was again forced to commit sorties directly to the air-to-air and air-to-ground battle because of the damage done to the SAM system. At least twenty-six Syrian aircraft were lost by 1400 hours and a total of thirty-two for the entire day, the highest Syrian air craft loss for the entire war on a single day. The IAF, in contrast, lost five.

The limited number of Syrian attack sorties (forty-four) was continuing proof of the success of the airfield interdiction campaign. Syrian airfields were attacked again on 13 October, but the success of the Israeli offensive is reflected in the lessening number of attack sorties flown (149).

General Herzog announced destruction of at least half the Syrian Air Force and heavy damage to most airfields by this time. Syrian attack sorties declined to thirty for the day, and the Syrian, and reportedly, Iraqi loss of twenty-two aircraft suggests continuing air-to-air opposition to the IAF, whose total loss for the day was again only five.

On the fourteenth, IAF attack priority switched to the Sinai, although Damascus International Airport was bombed again, and attack sorties in Syria declined to fifty-five (they would average only twenty-nine a day until the end of the war). In *The War of Atonement*, General Herzog notes that Syria was showing signs of desperation by the fourteenth. The IAF had been continually rendering Syrian airfields unusable. He indicated that at one stage Syrian fighter aircraft were forced to land on highway strips because all the airfields had sustained damage.

The Syrian sortie rate very directly reflected this denial of the Main Operating Bases. The Soviet resupply airlift was also hindered by the airfield damage. Syrian attack sorties stayed at a low level (with losses of thirty-seven aircraft) until the 17th. No Syrian attack sorties were flown from 18-20 October. In a one-day resurgence on the 21st, 100 attack sorties were flown (with a total loss of fifteen aircraft). The sorties again declined until the war ended.

The Syrian resurgence on the 21st was matched by fifty-five IAF attack sorties and an increase in IAF air defense sorties. The number of (probably major) raids during the war on individual Syrian airfields are listed below:³²

<u>Airfield</u>	<u>No. of Raids</u>
Aleppo	1
An Nasiryah	3
Damascus International Airport	3

Damascus/Mezze	4
Dumayr	4
Kholkhole	4
Marj Ruhayyil	4
Sayqal	4
Tiyas (T-4)	1

IAF WEAPONS AND TACTICS

Release by the IAF of a series of excellent strike camera photographs have provided details of their airfield attacks in the 1973 war. The IAF utilized general-purpose bombs delivered by dive-bombing with good accuracy. Repeated bombing of runways was employed to keep the airfields inoperable. Syrian airfields were reportedly easier to repair because of terrain differences. The repair problems at Egyptian airfields were caused by a high water table and sandy soil.³³ This fact may be reflected in the higher average number of attacks per airfield for Syria than for Egypt. The strike camera photographs reflect precision bomb deliveries at the mid-points and at the ends of runways and parallel taxiways as well as evidence of repairs from previous strikes in a number of cases.³³

Dummy aircraft were observed and photographed on open hardstands at EAF³⁴ (and probably Syrian) airfields but these were apparently ignored by the IAF (as most of them had been in 1967).

A Soviet article provided some details on IAF operations in 1973. According to the Soviets, after the initial heavy losses from air defense forces, the IAF directed its primary effort against radars, air defense command posts and SAM/AAA forces. Most strikes by groups of twenty-four to thirty aircraft were reduced to echeloned operations by small groups numbering four to eight aircraft. Aircraft approaches were at twenty to twenty-five meters altitude. Anti-radar missile launches were carried out from twenty to twenty-five kilometers followed by bombing attacks against SAMs and radars and then attacks on fighter airfields.³⁵ The IAF utilized the AGM-45 SHRIKE, AGM-78 Standard ARM, and cluster munitions against SAM/AAA targets.

IAF ECM

During the 1973 war the IAF employed self-protection jamming pods, chaff, and support jamming.³⁶ In addition, technical representatives from some major US ECM equipment manufacturers, including Hughes, Litton and Westinghouse, were present during the war to provide field solutions to operational electronic warfare problems.³⁷ At the beginning of the war the IAF already possessed US pods (ALQ-71, ALQ-87 and ALQ-101-6) capable of jamming the SA-2 B/C and the SA-3. The IAF indicated that these pods were effective. Although a US pod with capabilities against the SA-6 and the ZSU-23-4 radar (GUNDISH) was delivered, it was apparently not used because of IAF fears about SA-6 home-on-jam capabilities.

The IAF used both support and self-protection chaff in combination with high-G maneuvers which was very effective against SAMs, including the SA-6 which homed in on the chaff rather than the aircraft.

When properly employed, support jamming was also very effective. The IAF utilized jamming helicopters close to the radar targets but outside SAM range. The SA-2 and SA-3 acquisition radars were degraded to the point of receiving no track information. SA-3 effectiveness was reportedly reduced by fifty percent. Both aircraft and helicopters were utilized in stand-off communications-jamming roles. Additionally, sixty-eight IAF combat aircraft had communications-jamming equipment.

SORTIE RATES AND LOSSES

The IAF flew 11,233 combat sorties between 6-24 October, 1973. About sixty-five percent (7263) were attack sorties and the rest for air defense. Seventy-three percent of the attack sorties were flown against Egypt. The average number of IAF attack sorties per day was 382 and the highest one day total was 633. The combined Arab sortie total was 7,320 of which exactly two-thirds were air defense missions. The Arabs flew an average of 128 attack sorties a day with their highest total on the first day (360).

The IAF lost 109 aircraft in combat or .91 per 100 sorties. The losses break down as follows:³⁸

SA-2/3/6 - 40

SA-7 - 6

AAA - 31

Air-to-Air- 15

Unknown - 17

The Israelis report that about 2,100 missiles were fired to down the forty aircraft but that forty-five Arab aircraft were also shot down by the same missiles. IAF losses in the early part of the war (6-11 October) were seventy-three aircraft with the highest loss for one day being twenty-four. Losses were evenly divided between the northern and southern fronts. The best available breakdown by type of aircraft lost is:

F-4 33-35

A-4 52-55

Mirage 8-12

Super Mystere 3

Mystere IV A 5-6

Helicopter 6

In addition, 115 F-4s and 97 A-4s sustained damage due to enemy action.³⁹

The Arab air forces lost a total of 501 aircraft. The majority (334) were lost in air-to-air combat (a loss ratio of 22 to 1).

Israeli ground defenses took a significant toll of Arab aircraft nearly equal to the total IAF loss. Hawk sites destroyed twenty-five aircraft and AAA got seventy-two. The IAF destroyed only twenty-two aircraft on the ground (a tribute to the hangarette) and a total of forty-eight Arab aircraft were lost to friendly (Arab) fire.

RESULTS OF THE 1973 WAR

In 1973, the hangarette insured the survival of the Arab air forces cutting the loss rate on the ground by ninety-five percent from 390-400 in 1967 to twenty-two. The IAF understood the hangarette problem prior to war

and concentrated its attacks on runways and taxiways, attempting to suppress Arab aircraft operations on a day-to-day basis. For their part the Arabs attempted to conduct rapid repairs after each attack with some degree of success. There is good evidence that the IAF was successful at suppressing Syrian Air Force operations at critical times in the conflict. The evidence is less clear that they were able to accomplish this against the EAF. The EAF originally planned to hold its fighter aircraft in reserve counting on IAF losses to the massive Egyptian SAM/AAA network to reduce the threat to the point where the EAF could deal with it.⁴⁰ The Syrians probably counted on the same situation. Unfortunately for these intentions, the IAF attacks against the defense networks, combined with the evolution of the ground war on both fronts, forced both air forces to commit to the air battle in order to attempt to stem Israeli advances. Because of continuing overwhelming superiority in combat pilot ability the IAF was able to achieve the same level of destruction in 1973 as it did in 1967 (approximately 450 aircraft destroyed).

The reasons for this can be seen as a continuing pattern and not as the imposition of radical tactics. A comparison of the Israeli/Arab aircraft loss rates and their causes in the undeclared battles that went on sporadically for six years between the 1967 and 1973 conflicts, with those during the 1973 war, makes it very clear that the former provided an accurate preview of the course and result of the latter. The figures for aircraft losses between July 1967 and May 1973 along with the October 1973 war (not including self-inflicted losses) and the tactical results they illuminate are as follows:

	<u>Air-to-Air</u>		<u>Ground-to-Air</u>		<u>Total</u>	
	<u>1967-73</u>	<u>1973</u>	<u>1967-73</u>	<u>1973</u>	<u>1967-73</u>	<u>1973</u>
IAF	2	15	15	77	27	109
Egypt/Syria	125	334	37*	97**	162	453

* 13 to Hawk

** 25 to Hawk

- Overwhelming IAF superiority in the air-to-air battle;
- Much higher IAF losses from ground defenses;
- Twenty-one to twenty-two percent of Arab losses to ground defenses;
- Twenty-five to thirty-five percent of the Arab loss to ground defenses was caused by SAMs; and
- Total IAF losses were seventeen to twenty-two percent of Arab losses.

LESSONS FROM THE BATTLE

In the Yom Kippur War the Arabs demonstrated that they had finally learned some of the painful lessons inflicted on them in the past. IAF counter air goals were much harder to achieve. Further expansion of the EAF and Syrian airfield structure significantly increased their air forces' dispersal capability. The construction of large numbers of hangarmettes solved the immediate aircraft survival problem on the ground. The IAF was forced to attack runways and taxiways to suppress the Arab air forces. Runway repair efforts made continual re-visits, penetrating a high SAM/AAA threat environment necessary. This air defense "wall" was a technologically advanced but semi-static substitute for a flexible and active offense. The IAF was initially surprised by some of the technical aspects of this "wall" but not overwhelmed and went immediately about the business of dealing with this problem operationally. The initial solutions were still costly but, in the context of combined-arms, eventually effective because the IAF was committed to the solution and kept the pressure on. The runway interdiction campaign in Syria relieved the battlefield at the critical time as surely as the destruction of aircraft in 1967 had done. Although the basic concept of this limited duration campaign was aircraft pin-down, another effect (with additional potential) may have been aircraft landing denial. This initial battlefield success was the key to the character of the entire conflict since it led to relief of pressure on the Syrian front and the eventual concentration of effort against Egypt.

The changing battlefield situation and the Israeli combined-arms penetration, which employed both ground and air assets, resulted in the destruction of the Arab air defense "wall". This eventually forced the Arab air forces to fight. This was a tactically disadvantageous course of action for a force which had not improved qualitatively since the 1967 war. The final aircraft loss figures in 1973 showed that the IAF achieved a comparable success to that achieved in 1967, although the dynamics of their counter air solutions were complicated by Arab ground-based defense advances in quantity and technology.

OBSERVATIONS

- *Israeli planning clearly understood the difficulties that the hangarette program posed.*
- *The Israeli operations put pressure on targets in a manner designed to force the Arabs to commit aircraft into airspace controlled by the Israelis.*
- *Hangarmettes allowed the Arab aircraft to survive, but control of the air could not be guaranteed by a passive approach. Israeli tactics soon began to degrade the SAM barrier.*
- *A pattern of Israeli attacks against peripheral Egyptian radar surveillance sites suggests an attempt to degrade early warning sufficiently to allow undetected penetration to airfield targets. The specific sites covered sea approaches to the Nile Delta.*
- *Attacks against Syrian high value command and control targets forced redistribution of the Syrian SAM defenses to cover Damascus. This reduced defenses covering the Golan Heights airspace just prior to the critical Israeli counterattack.*
- *The IAF flew a well conceived airfield attack campaign against all Syrian airfields within 120 NM of the front to force a dramatic reduction in Syrian Air Force sortie generation capability at the time of critical counterattack on the Golan.*
- *Reconnaissance photos suggest a strong IAF training emphasis on the accurate delivery of bombs against runways and taxiways.*

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10. The range (radius) of an operational bomber sortie with 1,000 lbs. of bombs was assumed to be 425 miles.
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39. USAF/CHO, p. 5.
40. Heikal, *Sphinx*, p. 184.
41. "Radioelectronic Warfare in the Israeli-Arab Wars," *Voenno Istoricheskiy Zhurnal* (Military History Journal) No. 7, 1980, p. 65.
42. USAF/CHO, p. 3.
43. "The Six Day War," *Born in Battle* No. 6, 1979 p. 18.
44. The Vautours reportedly flew on one engine at 23-26,000 feet to conserve fuel during the inbound and outbound portions of the mission.
45. *Flight International*, July 1967.
46. This greatly extended time over target may be in error as closer continuity between succeeding strike formations could have given observers a false impression.
47. Robert R. Rodwell, "The Bomb That Won a War," *Flight International*, June 22, 1967, p. 1007.
48. Other conflicting reports allege the destruction of 10 Iraqi MIG-21s and a number of Iraqi Hunters.
49. "Egyptian Air Force Destroyed in 170 Minutes," *Jerusalem Post*, July 3, 1967.
50. Not in every case. In addition to bombs on runways intersections, Al Arish suffered rocket strikes on its control tower, bombing of a hangar and strafing of fuel trucks. *Aviation Week Reprint*, p. 35.
51. Although some reports identify Habbaniyah near Baghdad as the target and others identify Day 3 as the day of the H-3 raid.
52. Chruchill, p. 86.

53. USAF/CHO, p. 2.
54. The IAF claims that none of its aerial losses were due to air-to-air combat but to attacks on aircraft being employed in the strike role. O'Ballance, p. 83.
55. O'Ballance, p. 82.
56. S.L.A. Marshall, *Swift Sword: The Historical Record of Israel's Victory, June 1967*, (Princeton: American Heritage Publishing Company, Inc. 1967), p. 32.

Section 10

1. Based on analysis of USAF Aeronautical Chart air information and reported IAF airfield targeting in 1973.
2. Frank Aker III, *Hammer of God, The Yom Kippur War, October, 1973* (San Diego: Nayensch Printers, Inc. 1967), p. 4.
3. *Selected Readings in Tactics: The Middle East War* (Ft. Leavenworth, Kansas: US Army Command and General Staff College, 1976), USACGSC RB100-2, Vol. I, pp. 5-13.
4. *The Development of Soviet Air Defense Doctrine and Practice* (Dunn Loring, Virginia: Historical Evaluation and Research Organization, April 1981). For Sandia National Laboratories, SAND 80-7146/1, p. 111. Hereinafter cited as *Soviet Air Defense*. These figures and the subsequent Syrian AAA totals represent at least a minimum number of available AAA equipment. One source states the Egyptians had 800 ZSU-23-4s in October 1973.
5. Edgar O'Ballance, *No Victor No Vanquished: The Yom Kippur War*. (San Rafael, California: Presidio Press, 1978), p. 282. Hereinafter cited as O'Ballance, *No Victor*.

The radar sites had 400 radars of various types - General Peled. These were probably combinations of EW/GCI and height-finder systems.

6. Insight Team of London Sunday Times, *The Yom Kippur War* (Garden City, New York: Doubleday and Company, 1974), p. 33. Hereinafter cited as *Yom Kippur War*.
7. Lawrence L. Whetten, *The Canal War: Four Power Conflict in The Middle East* (Cambridge, Massachusetts: The MIT Press, 1974), p. 95.
8. Reported to be Aswan, Beni Suef, Cairo West, El Mansura, Inchas and Jiyanklis New.

9. *Yom Kippur War*, p. 119.
10. After the war, the Israeli Chief of Staff General Elazar also stated that the IAF was ready to execute this strike but was not allowed to for political reasons. "Israel's Elazar Evaluates The Yom Kipur War;" *Aerospace Daily*, November 5, 1975.
11. *Yom Kippur War*, p. 124-125.
12. "Both Sides of the Suez: Airpower in the Middle East," *Aviation Week and Space Technology Reprint* (1974), p. 38. Hereinafter cited as *Aviation Week Reprint*.
13. O'Ballance, *No Victor*, p. 70.
14. Avraham Adan, *On the Banks of the Suez* (London: Arms and Armour Press, 1980), p. 81. Hereinafter cited as Adan, *Suez*.
15. Chaim Herzog, *The War of Atonement*, (Boston: Little, Brown and Company, 1956), p. 256. Hereinafter cited as Herzog, *War*.
16. *Soviet Air Defense*, p. 113.
17. Adan, *Suez*, p. 81.
18. David Nicolle, "The Holy Day Air War," *Air Enthusiast International*, May 1974. Hereinafter cited as "Air War," May 1974.
19. Adan, *Suez*, p. 41.
20. Herzog, *War*, p. 260. One identified reason for keeping this airspace safe was to enable the IAF to support continued Israeli occupation of one of the Bar-Lev fortification known as "Budapest."
21. USAF/XO and USAF/IN. "1973 War Issues, Collection of Working Papers, 21-29 November, 1973," Paper on Aircraft Survivability, 24 November 1973, p. 2. Hereinafter cited as USAF Papers, 1973.
22. Murray Rubenstein and Richard Goldman, *Shield of David: An Illustrated History of the Israeli Air Force* (Englewood Cliffs, New Jersey: Prentice Hall, 1978), p. 129.
23. "The Air War in the Middle East," *Born in Battle*, No. 2, 1978. Hereinafter cited as *Born in Battle* No. 2.
24. "A War That Broke the Myths," *Newsweek*, October 22, 1973.
25. "Air War," May 1974.

26. "Golan War Part 2: The Air War," *Born in Battle*, No. 15, 1980.
27. "Soviet Aid Sparks Arab Gains," *Aviation Week and Space Technology*, October 1973.
28. "Golan War Part 2: The Air War," *Born in Battle*, No. 15, 1980.
30. O'Ballance, *No Victor*, p. 295.
31. The complete loss figures presented in "Soviet Air Defense" are believed to be accurate. The real IAF loss of 3 aircraft contrasts greatly with alleged "eye-witness" accounts of 7 "confirmed" IAF losses (and 43 reported by the Syrians). At the least, this appears to re-confirm the historic unreliability of humans as observers of phenomena - a burning MIG-21 probably looks a lot like a burning f-4 to the untrained and distant observer.
32. The following airfields were hit in this attack: An Nasiriyah, Damascus International Airport, Damascus/Mezze, Dumayr, Kholkhole, Marj Ruhayyil, Sayqal and Tiyas (T-4).
33. *Born in Battle*, No. 2.
34. *Aviation Week Reprint*, p. 44-47.
35. Cecil Brownlow, "Soviets Pose Three-Front Global Drive," *Aviation Week and Space Technology*, October 1973.
36. "Radioelectronic Warfare in the Israeli-Arab Wars," *Voenno Istoricheskiy Zhurnal* (Military History Journal), No. 7, 1980, p. 1.
36. USAF Papers, 1973, Israeli ECM, 21 November 1973, p. 1-2.
37. Robert R. Rodwell, "The Middle East Conflict," *Flight International*, November 1973.
38. *Soviet Air Defense*, p. 107-108, 113.
39. "USAF/DO Memorandum for Record," 8 November 1973, p. 3.
40. Herbert J. Coleman, "Israel: Air Force Decisive in War," *Aviation Week and Space Technology*, November, 1973.

Appendix C

1. This listing of units is based on a number of sources. The judgement that these forces were available for combat is based primarily on a listing presented by Klee, pp. 131-133. Klee cites the following

sources: *Die Stellenbesetzung der Fliegenden Verbände der deutschen Luftwaffe* (June-Juli 1940) and, *Geschwader-Kommodore und Gruppenkommandure der Aufklärungsverbände, Jagdverbände Kampfverbände, Stuka- und Schlachtflieger sowie Ergänzungseinheiten.*

2. The names shown in parenthesis are the popular nicknames for the *Geschwader* or *Gruppe* in question.
3. Literally "wooden hammer" or "maul."
4. "Lightning-Geschwader."
5. Named for Albert Leo Schlageter, a WWI officer who became a national hero when he was executed by the French in 1923 for resisting the occupation of the Ruhr.
6. During the battle, JG51 was commanded by Major Werner Mölders. Mölders was killed in the war on the Eastern front after achieving 115 personal air victories.
7. "Greenheart."
8. Klee, p. 132 does not agree with Mason p. 593 on the presence of I/StG3. Mason shows KGr806 and 3./Aufklgr 31 as subordinates of StG3.
9. "Death's head-Geschwader."
10. "Griffon-Geschwader."
11. "Ace-of-Spades."
12. "Lion-Geschwader."
13. "Eagle-Geschwader."

Appendix D

1. Not printed.
2. A successful initial attack on the key element of either of those systems would demand the immediate concentration of effort on the remaining elements of that system to exploit the initial success.

are numbered consecutively through the *Gruppen* 5/JG54 is a *Staffel* of II *Gruppe*.

- Many units also bear honorific nicknames e.g. JG54 "Grünherz". JG54 is therefore occasionally referred to as the "Greenheart Geschwader."

The common unit types are

JG = <i>Jagdgeschwader</i>	Fighter
KG = <i>Kampfgeschwader</i>	Bomber
StG= <i>Stukageschwader</i>	Dive bomber
LG = <i>Lehrgeschwader</i>	Instruction unit, often served in combat as bomber units
ZG = <i>Zerstörergeschwader</i>	"Destroyer", specifically the Bf 110/Me 410
NJG = <i>Nachtjagdgeschwader</i>	Nightfighter

In addition there are some specialized unit types which were organized only at the *Gruppe* or *Staffel* level.

ErprGr = *Erprobungsgruppe* - Operational trials unit. ErprGr 210, as an example, flew in the battle of Britain as a specialized attack unit with Bf 110 and bomb-carrying Bf 109 aircraft.

Aufkl.Gr. = *Aufklärungsgruppe* - Reconnaissance group.

Wekusta = *Wetterkundungsstaffel* - Weather reconnaissance Staffel.

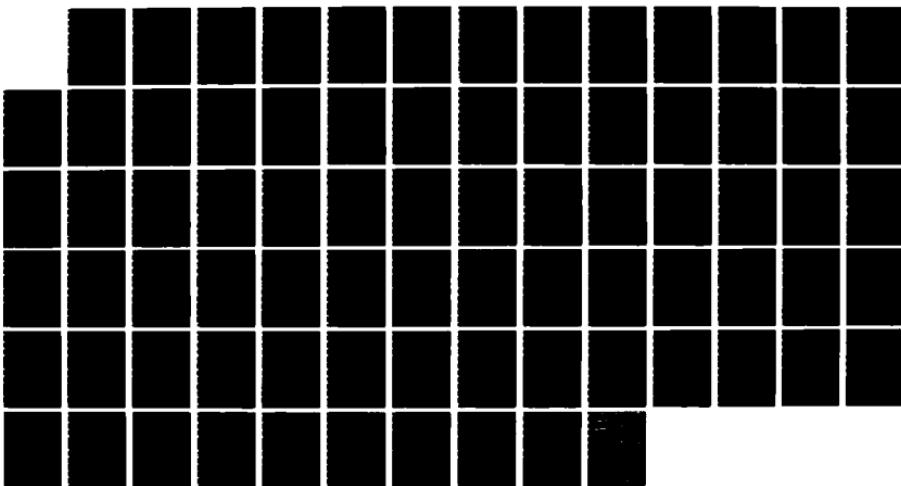
AD-A166 210 AIR SUPERIORITY AND AIRFIELD ATTACK - LESSONS FROM
HISTORY(U) BDM CORP MCLEAN VA B L BLUSTONE ET AL
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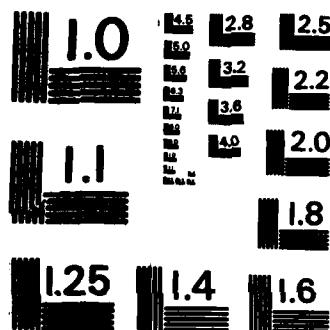
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MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS - 1963 - A

APPENDIX A

NOTES ON UNIT DESIGNATIONS

No attempt has been made in this monograph to rectify all air forces to a single standard of designation for units. The terms used are those used by the air force under discussion. The single exception is the Soviet Air Forces where the term "polk" has been translated to "regiment" and "diviziya" to "division".

Luftwaffe designations

Luftflotte - "Air Fleet" - a self-contained geographically based air group.

Fliegerkorps - "Flier Corps" a general headquarters of composite units. Initially intended as the operating HQ of a Luftflotte. Later this HQ controlled bomber and reconnaissance units while fighters were controlled by the *Jagdfliegerführer* (Jafu) or "Fighter leader".

Geschwader - Intended to be the largest "type formation." The unit establishment for a fighter Geschwader was 3 x 39 plus a staff flight for a total of 120 fighters. The sub-composition of a *Geschwader* is the *Gruppe* with a strength of 39 aircraft. Each *Gruppe* was composed of three *Staffeln*.

The notation system for Luftwaffe units is: I/JG54

- Roman numerals indicate *Gruppe*;
- JG is the abbreviation for the type unit, i.e., *Jagdgeschwader*-Fighter unit;
- The Arabic numerals in the final position is the unit designator, in this case 54;
- Arabic numerals in the first position indicate the *Staffel* e.g. 5/JG54 is fifth *Staffel* of JG54 and since the *Staffeln*

APPENDIX B

GERMAN INTELLIGENCE APPRECIATION OF THE R.A.F. AND COMPARISON WITH CURRENT LUFTWAFFE STRENGTH

Oberkommando der Luftwaffe
16th July 1940

Operations Staff 1 C

I. THE MILITARY VALUE OF THE R.A.F.

A. STRENGTH AND EQUIPMENT

1. FIGHTER FORMATIONS

With 50 fighter squadrons each having about 18 aircraft, there are 900 first line fighters available of which approximately 675 (75 percent) may be regarded as serviceable.

About 40 percent of the fighters are Spitfires and about 60 percent are Hurricanes. Of these types the Spitfire is regarded as the better.

In view of their combat performance and the fact that they are not yet equipped with cannon guns both types are inferior to the Bf 109, while the individual Bf 110 is inferior to skillfully handled Spitfires.

In addition to the above formations Blenheim squadrons are available for night fighter tasks as auxiliary heavy fighters and operate in cohesion with particularly intense searchlight defence.

2. BOMBING FORMATIONS

Assuming the average squadron strength to be 20 aircraft, the 55 to 60 bomber squadrons contain about 1,150 firstline bombers of which about 860 (75 percent) may be regarded as serviceable.

This strength is divided among four types of aircraft of various series, approximately as follows:

Hampden	400
Wellington	350
Whitley	300
Lockheed Hudson	100

Comparison of these types shows that the Hampden has the best qualities as a bomber.

In addition, there is a large number of Blenheim bombers available. Most of these are in training schools but there are also some in operational units. However, in view of its performance, this type can no longer be considered a firstline aircraft.

In comparison with German bombers all these types have inadequate armour, and poor bomb-aiming equipment. However, they usually have strong defensive armament.

3. OTHER FORMATIONS

These include coastal formations equipped with Lockheed Hudsons (reconnaissance) and flying-boats and various obsolescent types of aircraft--close reconnaissance and low-level attack aircraft designed for co-operation with the army.

These need not be taken into consideration in this report.

4. ANTI-AIRCRAFT ARTILLERY

In view of the island's extreme vulnerability to air attack and the comparatively limited amount of modern equipment the number of heavy and light AA. guns available (1,194 plus 1,114) is by no means adequate to ensure the protection of the island by ground defences.

The large number of efficient searchlights available (3,200) constitutes an advantageous factor in defence at night.

Only limited importance should be attributed to the numerous barrage balloons, as these can be used only at low altitudes (1,000 to 2,000 meters) owing to the medium wind velocities prevailing over the island. The balloons cannot be raised at all at appreciable wind velocities.

B. PERSONNEL AND TRAINING

At present there are no difficulties regarding the number of men available.

From the outset the training is concentrated on the production of good pilots and the great majority of the officers in particular are trained solely as such. By comparison tactical training is left far in the background. For this reason the R.A.F. has comparatively well-trained fighter pilots while bomber crews are not up to modern tactical standards. This applies to the bomb-aimers in particular, most of whom are N.C.O.s and men with little service experience. Although there are deficiencies in equipment the comparatively low standard of bombing accuracy may be attributed to this factor.

C. AIRFIELDS

In the ground organisation there is a considerable number of air-strips in the southern part of the island and in some areas in the north. However, only a limited number can be considered as operational airfields with modern maintenance and supply installations.

In general, the well-equipped operational airfields are used as take-off and landing bases, while the numerous smaller airfields located in the vicinity serve as alternative landing grounds and rest bases.

There is little strategic flexibility in operations as ground personnel are usually permanently stationed at home bases.

D. SUPPLY SITUATION

1. As regards aircraft, the R.A.F is at present almost entirely dependent on home production. American deliveries will not make any important contribution before the beginning of 1941.

If deliveries arriving in Britain in the immediate future are supplemented by French orders these aircraft may be ready for operations by the autumn.

At present the British aircraft industry produces about 180 to 300 first line fighters and 140 first line bombers a month. In view of the present conditions relating to production (the appearance of raw material difficulties, the disruption or breakdown of production at factories owing to air attacks, the increased vulnerability to air attack owing to the fundamental reorganisation of the aircraft industry now in progress) it is believed that for the time being output will decrease rather than increase.

In the event of an intensification of air warfare it is expected that the present strength of the R.A.F will fall and this decline will be aggravated by the continued decrease in production.

2. Unless an appreciable proportion of present stocks is destroyed, the fuel situation can be regarded as secure.

3. *Bombs.* Bomb production is limited by the method of manufacture (cast casings). However there will be no difficulty in the supplies of bombs so long as present stocks are not used and operations continue on a moderate scale. It is believed that these stocks will be adequate for intensive operations lasting several weeks.

Most of the bombs available are of medium calibre (112 and 224 kilogrammes), of which a large proportion are of an obsolete pattern with unfavorable ballistic qualities (bombs with fins).

E. COMMAND

The Command at high level is inflexible in its organization and strategy. As formations are rigidly attached to their home bases, command at medium level suffers mainly from operations being controlled in most cases by officers no longer accustomed to flying (station commanders). Command at low level is generally energetic but lacks tactical skill.

II. THE OPERATIONAL SCOPE OF THE R.A.F.

(a) For its operations the R.A.F. has at its disposal an area of only 200 to 300 kilometers in depth. This corresponds approximately to an area the size of the Netherlands and Belgium.

There is little possibility of Ireland being used in the system of depth owing to the lack of ground organization and the fact that once R.A.F. units have been transferred there they cannot restore their serviceability.

In contrast the *Luftwaffe* has at its disposal an area extending from Trondheim, across Heligoland Bay and along the North Sea and Channel coasts to Brest with a practically unlimited zone in depth.

(b) In view of the inferiority of British fighters to German fighters, enemy bomber formations even with fighter escort are not capable of carrying out effective daylight attacks regularly, particularly as escort operations are in any case limited by the lack of long-range single-engine or heavy fighters.

The R.A.F will therefore be obligated to limit its activity primarily to night operations even in the advent of intensified air warfare. These operations will undoubtedly achieve a nuisance value but will in no way be decisive.

In contrast, the *Luftwaffe* is in a position to go over to decisive daylight operations owing to the inadequate air defenses of the island.

III. CONCLUSION

The *Luftwaffe* is clearly superior to the R.A.F. as regards strength, equipment, training, command and location of bases. In the event of an intensification of air warfare the *Luftwaffe*, unlike the R.A.F., will be in a position in every respect to achieve a decisive effect this year if the time for the start of large-scale operations is set early enough to allow advantage to be taken of the months with relatively favourable weather conditions (July to the beginning of October).

APPENDIX C

**R.A.F. FIGHTER COMMAND ORDER OF BATTLE
09.00 HRS., 1ST JULY 1940**

<u>SECTOR</u>	<u>SQUADRON</u>	<u>AIRCRAFT</u>	<u>COMBAT READY/NOR</u>	<u>BASE AIRFIELD</u>	<u>PILOTS ASSIGNED AND AVAILABLE</u>
No. 11 Group, H.Q. Uxbridge, Middlesex					
<u>Biggin Hill</u>	32 Sqdn.	Hurricane	12/4	Biggin Hill	16
	79 Sqdn. (1)	Hurricane	12/5	Biggin Hill	14
	245 Sqdn. (2)	Hurricane	15/1	Hawkinge	16
	600 Sqdn.	Blenheim	8/6	Manston	22
	610 Sqdn.	Spitfire	14/3	Gravesend	20
<u>North Weald</u>	25 Sqdn.	Blenheim	6/10	Martlesham	22
	56 Sqdn.	Hurricane	16/2	North Weald	20
	85 Sqdn.	Hurricane	15/3	Martlesham	21
	151 Sqdn.	Hurricane	14/4	North Weald	20
<u>Kenley</u>	64 Sqdn.	Spitfire	10/4	Kenley	19
	111 Sqdn.	Hurricane	12/4	Croydon	17
	501 Sqdn.	Hurricane	10/5	Croydon	18
	615 Sqdn.	Hurricane	12/6	Kenley	21
<u>Northolt</u>	1 Sqdn.	Hurricane	10/6	Northolt	18
	257 Sqdn.	Hurricane	13/5	Hendon	17
	604 Sqdn.	Blenheim	10/6	Northolt	21
	609 Sqdn.	Spitfire	15/2	Northolt	18
<u>Hornchurch</u>	54 Sqdn.	Spitfire	12/3	Rochford	18
	65 Sqdn.	Spitfire	11/5	Hornchurch	16
	74 Sqdn.	Spitfire	10/7	Hornchurch	20
<u>Tangmere</u>	43 Sqdn.	Hurricane	13/4	Tangmere	18
	145 Sqdn.	Hurricane	11/7	Tangmere	17
	601 Sqdn.	Hurricane	15/2	Tangmere	19
	F.I.U. (3)	Blenheim	4/4	Tangmere	10
<u>Filton</u>	92 Sqdn.	Spitfire	11/6	Pembrey	19
	213 Sqdn.	Hurricane	14/4	Exeter	20
	234 Sqdn.	Spitfire	9/6	St. Eval	21
<u>Middle Wallop</u>	236 Sqdn.	Blenheim	11/4	Middle Wallop	19
	238 Sqdn. (4)	Hurricane	10/2	Middle Wallop	17
<u>Debden</u>	17 Sqdn.	Hurricane	14/4	Debden	19
No. 12 Group, H.Q. Watnall, Nottingham					

R.A.F. FIGHTER COMMAND ORDER OF BATTLE
09.00 HRS., 1ST JULY 1940

<u>SECTOR</u>	<u>SQUADRON</u>	<u>AIRCRAFT</u>	<u>COMBAT READY/NOR</u>	<u>BASE AIRFIELD</u>	<u>PILOTS ASSIGNED AND AVAILABLE</u>
<u>Duxford</u>	19 Sqdn.	Spitfire	8/5	Fowlmere	24
	264 Sqdn.	Defiant	11/7	Duxford	23
<u>Coltishall</u>	66 Sqdn.	Spitfire	12/4	Coltishall	25
	242 Sqdn.	Hurricane	10/4	Coltishall	21
<u>Kirton-in-Lindsey</u>	222 Sqdn.	Spitfire	12/4	Kirton-in-Lindsey	21
<u>Digby</u>	29 Sqdn.	Blenheim	10/5	Digby	15
	46 Sqdn.	Hurricane	15/3	Digby	17
	611 Sqdn.	Spitfire	3/11	Digby	21
<u>Wittering</u>	23 Sqdn.	Blenheim	10/6	Colly Weston	20
	229 Sqdn.	Hurricane	14/2	Wittering	20
	266 Sqdn.	Spitfire	8/5	Wittering	21

No. 13 Group, H.Q. Newcastle, Northumberland

<u>Church Fenton</u>	73 Sqdn.	Hurricane	8/5	Church Fenton	22
	87 Sqdn.	Hurricane	14/4	Church Fenton	23
	249 Sqdn.	Hurricane	10/4	Leconfield	23
	616 Sqdn.	Spitfire	11/4	Church Fenton	19
<u>Catterick</u>	41 Sqdn.	Spitfire	11/6	Catterick	21
	219 Sqdn.	Blenheim	10/4	Catterick	19
<u>Usworth</u>	72 Sqdn.	Spitfire	12/4	Acklington	19
	152 Sqdn.	Spitfire	8/4	Acklington	25
	607 Sqdn.	Hurricane	10/6	Usworth	17
<u>Turnhouse</u>	41 Sqdn.	Defiant	14/5	Turnhouse	20
	253 Sqdn.	Hurricane	13/5	Turnhouse	19
	602 Sqdn.	Spitfire	12/4	Drem	19
	603 Sqdn. (5)	Spitfire	10/6	Turnhouse	19
	605 Sqdn. (6)	Hurricane	8/6	Drem	17
<u>Dvce</u>	263 Sqdn. (7)	Hurricane	3/2	Grangemouth	7
<u>Wick</u>	3 Sqdn.	Hurricane	12/2	Wick	18
	504 Sqdn.	Hurricane	12/4	Castletown	15
			640/265		1063

R.A.F. FIGHTER COMMAND ORDER OF BATTLE
09.00 HRS., 1ST JULY 1940

NOTES:

- (1) Squadron moving to Hawkinge. Non-operational during transit.
- (2) Squadron ready to move to Turnhouse and rest and re-train.
- (3) Fighter Interceptor Unit.
- (4) Squadron non-operational. Still working up after recent formation.
- (5) Flights detached at Dyce and Montrose.
- (6) Squadron non-operational. Resting and re-training.
- (7) One flight only. Still working up.

*Based on material presented in Francis K. Mason, *Battle Over Britain*.

Luftwaffe Air Assets Available ¹
Operations Against Great Britain
1 July 1940

Luftflotte 2, Headquarters Brussels, Belgium bases in Holland, Belgium, and in France East of the Somme. Commanded by Generalfeldmarschall Albert Kesselring.

<u>Formation</u>	<u>HQ/Base Location</u>	<u>A/C Type</u>
I <i>Fliegerkorps</i>	Beauvais, Fr.	
Kampfgeschwader 1 (KG1) ("Hindenburg") ²	Rosieres-en-Santerre	He 111
I/KG1	Montdidier	He 111
II/KG1	Montdidier	He 111
III/KG1	Rosieres-en-Santerre	He 111
Kampfgeschwader 76 (KG76)	Cormeilles-en-Vexin	Do 17
I/KG76	Beauvais	Do 17
II/KG76	Creil	Ju 88
III/KG76	Cormeilles-en-Vexin	Do 17
II <i>Fliegerkorps</i>	Ghent Bel.	
Kampfgeschwader 2 (KG2) ("Holzhammer") ³	Arras	Do 17
I/KG2	Epinoy	Do 17
II/KG2	Arras	Do 17
III/KG2	Cambrai	Do 17
Kampfgeschwader 3 (KG3) ("Blitz-Geschwader") ⁴	Le Culot	Do 17
I/KG3	Le Culot	Do 17
II/KG3	Antwerp/Deurne	Do 17
III/KG3	St. Trond	Do 17
Kampfgeschwader 53 (KG53) ("Legion Kondor")	Lille-Nord	Do 17
I/KG53	Lille-Nord	Do 17
II/KG53	Lille-Nord	Do 17
III/KG53	Lille-Nord	Do 17
II Gruppe, Stukageschwader 1 (II/StG1)	Pas de Calais	Ju 87

<u>Formation</u>	<u>HO/Base Location</u>	<u>A/C Type</u>
IV (<i>Stuka</i>) Gruppe, Lehr-geschwader 1 (IV (<i>Stuka</i>)/LG1)	Pas de Calais	Ju 87
II Gruppe, Lehrgeschwader 2 (II/LG2)	St. Omer	? Bf 109E-7?
NOTE: II <i>Fliegerkorps</i> also incorporated the highly successful Operational Evaluation Unit <i>Erprobungs Gruppe</i> 210 (EprGr 210) later in July.		
IX Fliegerdivision	Soesterberg, Holland	
Kampfgeschwader 4 (KG4) ("General Wever")	Soesterberg	He 111
I/KG4	Soesterberg	He 111
II/KG4	Eindhoven	He 111
III/KG4	Amsterdam/Schipol	Ju 88
Kampfgruppe 100 (KGr100)	Vannes, France	He 111
Kampfgeschwader 40 (KG40) I/KG40	Brest	FW 200
Jagdfliegerfuher 2 (Jafu 2) Jagdgeschwader 3 (JG3) ("Udet")	Wissant, France Samer	Bf 109E
I/JG3	Colourhert	Bf 109E
II/JG3	Samer (after 14.8.40)	Bf 109E
III/JG3	Desores	Bf 109E
*JG3 is held by Klee to have been available in July 1940 but its rebasing was not complete until mid August.		
Jagdgeschwader 26 ("Schlageter") ⁵	Audembert, France	Bf 109E
I/JG26	Audembert	Bf 109E
II/JG26	Marquise	Bf 109E
III/JG26	Caffiers	Bf 109E
Jagdgeschwader 51 (after 1941 "Mölders") ⁶	Wissant, France	Bf 109E
I/JG51	Wissant	Bf 109E
II/JG51	Wissant	Bf 109E
III/JG51	St. Omer	Bf 109E

<u>Formation</u>	<u>HQ/Base Location</u>	<u>A/C Type</u>
<i>Jagdgeschwader 52 (JG52)</i> I/JG52 II/JG52	Coquelles, France Coquelles Peuplinge	Bf 109E Bf 109E Bf 109E
<i>Jagdgeschwader 54 (JG54)</i> ("Grünerz") ⁷ I/JG54 II/JG54 III/JG54	Campagne, France Guines Hermalingen Guines	Bf 109E Bf 109E Bf 109E
<i>I Gruppe, Lehrgeschwader 2</i> (I/LG2)	<i>Calais-Marck, France</i>	<i>Bf 109E</i>
<i>Zerstörergeschwader 26</i> (ZG 26) ("Horst Wessel") I/ZG26 II/ZG26 III/ZG26	Lille, France Yvrench Crecy Barley	Bf 110 Bf 110 Bf 110 Bf 110

Luftflotte 3 Headquarters Paris, France, bases in north and northwest France, commanded by Generalfeldmarschall Hugo Sperrle.

<u>Formation</u>	<u>HO/Base Location</u>	<u>A/C Type</u>
IV Fliegerkorps	Forward HQ, Dinard, Rear HQ, Compeigne	
<i>Lehrgeschwader 1, (LG1)</i>		Ju 88
I/LG1	Orleans/Bricy	Ju 88
II/LG1	Orleans/Bricy	Ju 88
III/LG1	Chateaudun	Ju 88
*NOTE: IV (Stuka)/LG1 was attached to <i>Luftflotte</i> 2 and was based at Pas de Calais with Ju 87 aircraft.		
<i>Kampfgeschwader 27 (KG27)</i> ("Bölkे")	Tours	He 111
I/KG27	Tours	He 111
II/KG27	Danard	He 111
III/KG27	Rennes	He 111
<i>Stukageschwader 3 (StG3)</i> 111	Nantes	Do 17, He
I/StG3 ⁸		
V Fliegerkorps	Villacoublay	
<i>Kampfgeschwader 51 (KG51)</i> ("Edelweiss-Geschwader")	Orly	Ju 88
I/KG51	Melun	Ju 88
II/KG51	Orly	Ju 88
III/KG51	Etampes	Ju 88
<i>Kampfgeschwader 54 (KG54)</i> ("Totenkopf-Geschwader") ⁹	Evreux	Ju 88
I/KG54	Evreux	Ju 88
II/KG54	Andre-de-L'Eure	Ju 88
<i>Kampfgeschwader 55 (KG55)</i> ("Grieven-Geschwader") ¹⁰	Villacoublay	He 111
I/KG55	Dreux	He 111
II/KG55	Chartres	He 111
III/KG55	Villacoublay	He 111
VIII Fliegerkorps	Deauville	

<u>Formation</u>	<u>HO/Base Location</u>	<u>A/C Type</u>
Stukageschwader 1 (StG1) *This Geschwader formed about 6 July.	Angers	Do 17
I/StG1	Angers	Ju 87
III/StG1	Angers	Ju 87
Stukageschwader 2 (StG2) ("Immelman-Geschwader")	St. Malo	Do 17
I/StG2	St. Malo	Ju 87
II/StG2	Lannion	Ju 87
Stukageschwader 77 (StG77)	Caen	Do 17
I/StG77	Caen	Ju 87
II/StG77	Caen	Ju 87
III/StG77	Caen	Ju 87
Jagdfliegerfuehrer 3 (Jafu 3)	Cherbourg	
Jagdgeschwader 2 (JG2) ("Richtofen")	Evreux	Bf 109E
I/JG2	Beaumont-le-Roger	Bf 109E
II/JG2	Beaumont-le-Roger	Bf 109E
III/JG2	LeHavre	Bf 109E
Jagdgeschwader 27 (JG27)	Cherbourg-West	Bf 109E
I/JG27	Plumetot	Bf 109E
II/JG27	Crepon	Bf 109E
III/JG27	Carquebut	Bf 109E
Jagdgeschwader 53 (JG53) ("Pik As") ¹¹	Cherbourg	Bf 109E
I/JG53	Rennes	Bf 109E
II/JG53	Dinan	Bf 109E
III/JG53	Sempy and Brest	Bf 109E
Zerstorergeschwader 2 (ZG2)	Tousee-le-Noble	Bf 110
I/ZG2	Amiens	Bf 110
II/ZG2	Guyancourt	Bf 110

Luftflotte 5, Headquarters, Stavanger, Norway, bases in Norway and Denmark, commanded by Generaloberst Hans-Jurgen Stumpff.

<u>Formation</u>	<u>HQ/Base Location</u>	<u>A/C Type</u>
X Fliegerkorps	Stavanger	
Kampfgeschwader 26 (KG26) ("Löwen-Geschwader") ¹²		He 111
I/KG26	Stavanger	He 111
III/KG26	Aalborg	He 111
Kampfgeschwader 30 (KG30) ("Adler-Geschwader") ¹³	Aalborg	Ju 88
I/KG30	Aalborg	Ju 88
III/KG30	Aalborg	Ju 88
Zerstörergeschwader 76 (ZG 76)	Stavanger	Bf 110
I/ZG76	Stavanger	Bf 110
Jagdgeschwader 77 II/JG77	Stavanger & Trondheim	Bf 109E
*I/JG77 transferred in late August to become IV/JG51 at St. Omer.		Bf 109E

APPENDIX D

THE COMBINED BOMBER OFFENSIVE FROM THE UNITED KINGDOM (POINTBLANK) AS APPROVED BY THE COMBINED CHIEFS OF STAFF, 14TH MAY 1943

1. THE MISSION

(a) The mission of the United States and British bomber forces, as prescribed by the Combined Chiefs of Staff at Casablanca, is as follows:

To conduct a joint United States-British air offensive to accomplish the progressive destruction and dislocation of the German military, industrial and economic systems, and the undermining of the morale of the German people to a point where their capacity for armed resistance is fatally weakened. This is construed as meaning so weakened as to permit initiation of final combined operations on the Continent.

2. THE PRINCIPAL OBJECTIVES

(a) A thorough study of those elements of the German military, industrial and economic system, which appeared to be profitable as bombing objectives, was made by a group of Operations Analysts consisting of eminent United States experts. The report of the Operations Analysts concludes that:

The destruction and continued neutralization of some sixty (60) targets would gravely impair and might paralyze the western Axis war effort. There are several combinations of targets from among the industries studied which might achieve this result.

(b) Examination of this report shows complete agreement by United States and British experts. From the systems proposed by the Operations Analysts, six systems, comprising seventy-six (76) precision targets, have been selected. These targets are located within the tactical radius of action of the two air forces, and their destruction is directed against the three major elements of the German Military machine: its submarine fleet, its air force, and its ground forces, and certain industries vital to their support.

(c) The six systems are:

Submarine construction yards and bases.
German aircraft industry.
Ball bearings.
Oil.
Synthetic rubber and tires.
Military transport vehicles.

Concentration of effort against these systems will have the following effect. The percent of destruction is as indicated by the Operations Analysts:

- (1) **Submarine construction yards and bases.** Destruction of the submarine building yards selected will reduce present submarine construction by eighty-nine percent (89%). Attack of submarine bases will affect the submarine effort at sea. If it is found that successful results can be achieved, these attacks should continue whenever conditions are favourable for as long and as often as is necessary.
- (2) **German aircraft industry.** Depletion of the German air force will fatally weaken German capacity to resist our air and surface operations. Complete domination of the air is essential for our ultimate decisive effort. Destruction of forty-three percent (43%) of the German fighter capacity and sixty-five percent (65%) of the German bomber capacity is provided for in this plan, and will produce the effect required.
- (3) **Ball bearings.** The critical condition of the ball-bearing industry in Germany is startling. The concentration of that industry renders it outstandingly vulnerable to air attack. Seventy-six percent (76%) of the ball bearing production can be eliminated by destruction of the targets selected. This will have immediate and critical repercussions on the production of tanks, airplanes, artillery, diesel engines--in fact, upon nearly all the special weapons of modern war.
- (4) **Oil.** The quantities of petroleum and synthetic oil products now available to the Germans is barely adequate to supply the life-blood which is vital to the German war machine. The oil situation is made more critical by failure of the Germans to secure and retain the Russian supplies. If the Ploesti refineries, which process thirty-five percent (35%) of current refined oil products available to the Axis, are destroyed, and the synthetic oil plants in Germany which process an additional thirteen percent (13%) are also destroyed, the resulting disruption will have a disastrous effect upon the supply of finished oil products available to the Axis.
- (5) **Synthetic rubber and tires.** These products are vital to all phases of German Military strength on land and in the air. Provision is made for destruction of fifty percent (50%) of the synthetic rubber capacity and nearly all of the tire production. This destruction will have a crippling effect.
- (6) **Military transport vehicles.** Seven (7) plants produce a large proportion of the military transport and armored vehicles. The precise proportion is unknown. Loss of these plants will strike directly at the German Military strength. The cumulative effect of the destruction of the targets comprising the systems just listed will fatally weaken the capacity of the German people for armed resistance.

(d) The selection of these objectives is confirmed by the fact that the systems about which the Germans are most sensitive, and about which they have concentrated their defenses, such as balloons, camouflage, anti-aircraft, searchlights, decoys and smoke, are:

Aircraft factories.
Submarine construction yards.
Ball-bearings.
Oil.

3. INTERMEDIATE OBJECTIVE

(a) The Germans, recognizing the vulnerability of their vital industries, are rapidly increasing the strength of their fighter defenses. The German fighter strength in western Europe is being augmented. *If the growth of the German fighter strength is not arrested quickly, it may become literally impossible to carry out the destruction planned and thus to create the conditions necessary for ultimate decisive action by our combined forces on the Continent.*

(b) Hence the successful prosecution of the air offensive against the principal objectives is dependent upon a prior (or simultaneous) offensive against the German fighter strength.

(c) To carry out the Eighth Air Force's part of this combined bomber offensive it will be necessary to attack precision targets deep in German territory in daylight. The principal obstacle to this is the growing strength of the German air force. The growth of this fighter force has become so pronounced as to warrant a brief review of this development (Chart A).1

(d) The upper curve shows what has been happening to the German air force in the past nine months. The bomber strength has been sharply reduced from 1,760 bombers to 1,450 in operational units. The fighters, on the other hand, increased from 1,690 to 1,710. They suffered a reduction in strength, doubtless caused by the intense operations in Russia and the Mediterranean as well as on the Western Front, but those losses have been made good at the expense of the bombers. That same trend is reflected in the lower curve, which shows production was maintained fairly constantly for about five months and then increased, so that fighter production has risen from 720 to 810 per month. Over a longer period of time, from the entrance of the United States into the war until the present time, the trend has been even more pronounced. German fighter strength has increased by forty-four percent (44%) in that period in spite of the heavy losses. This chart shows the margin of production over average monthly wastage in German fighters. Of course, the monthly wastage has not been constant over the past seven months, as shown on the chart, but the average for that period has been fairly accurately determined at 655 fighters per month. The production rate as of last February showed 810 fighters per month. The average increase in production over the six-month period depicted indicates a monthly surplus of production over average wastage of 108 airplanes. If this trend simply continues in its present ratio, it is well within the capacity of the Germans to produce enough fighter airplanes over and above

wastage to provide a strength of 3,000 fighters by this time next year. (See Chart B.¹) This is, of course a capability and not necessarily a German intention, although current German development points very strongly in that direction. The increase in fighter strength is not reflected in this curve covering the past eight months; however, during that period the Germans converted a great many fighter-type airplanes into fighter bombers and fighter reconnaissance airplanes. The wastage rate was very high in those units and that probably accounts for the temporary decline in German fighter strength; however, in the last three months it has shown a sharp uprise.

(e) The disposition of German fighters is also significant (see Chart C).¹ The top line shows the number of fighters on the Western Front. Since we entered the war that strength has nearly doubled. It has risen from 420 to 830. This, in spite of the heavy drains on the Russian and Mediterranean fronts. When we entered the war only thirty-six percent (36%) of German fighters were concentrated on the Western Front; today, fifty percent (50%) of all fighters available to the German air force are concentrated in opposition to our principal bombing effort from the United Kingdom. The German fighter force is taking a toll of our forces both by day and by night, not only in terms of combat losses, but more especially in terms of reduced tactical effectiveness. If the German fighters are materially increased in number it is quite conceivable that they could make our daylight bombing unprofitable, and perhaps our night bombing, too. On the other hand, if the German fighter force is partially neutralized our effectiveness will be vastly improved.

(f) For this reason German fighter strength must be considered as an *Intermediate* objective second to none in priority.

4. INTEGRATED R.A.F.--UNITED STATES ARMY AIR FORCES' OFFENSIVE

(a) The combined efforts of the entire United States and British bomber forces can produce the results required to achieve the mission prescribed for this theater. Fortunately the capabilities of the two forces are entirely complementary.

(b) The tremendous and ever-increasing striking power of the R.A.F. bombing is designed to so destroy German material facilities as to undermine the willingness and ability of the German worker to continue the war. Because of this, there is great flexibility in the ability of the R.A.F. to direct its material destruction against those objectives which are closely related to the United States bombing effort which is directed toward the destruction of specific essential industrial targets. It is considered that the most effective results from strategic bombing will be obtained by directing the combined day and night effort of the United States and British bomber forces to all-out attacks against targets which are mutually complementary in undermining a limited number of selected objective systems. All-out attacks imply precision bombing of related targets by day and night where tactical conditions permit, and area bombing by night against the cities associated with these targets. The timing of the related day and night attacks will be determined by tactical considerations.

(c) This plan does not attempt to prescribe the major effort of the R.A.F. Bomber Command. It simply recognizes the fact that when precision targets are bombed by the Eighth Air Force in daylight, the effort should be complemented and completed by R.A.F. bombing attacks against the surrounding industrial area at night. Fortunately the industrial areas to be attacked are in most cases identical with the industrial areas which the British Bomber Command has selected for mass destruction anyway. They include Hamburg, Bremen, Hanover, Berlin, Leipzig, Wilhelmshaven, Bremerhaven, Cologne, Stuttgart, and many other principal cities. They also, of course, include smaller towns whose principal significance is coupled with the precision targets prescribed for the Eighth Air Force.

5. GENERAL PLAN OF OPERATIONS

(a) It would be highly desirable to initiate precision bombing attacks against German fighter assembly and engine factories immediately. However, our present force of day bombers is too small to make the deeper penetrations necessary to reach the majority of these factories. Considering the number of German fighters which can be concentrated laterally to meet our bombers on penetration, and again on withdrawal, it is felt that 300 heavy bombers is the minimum operating force necessary to make deep penetrations.

(b) The general tactical plan of operations with this minimum force involves the following general conception: a holding attack intended to attract German fighters to a particular area and prevent their massing against the main attacking force. For this purpose 50 heavy bombers with fighter escort are required. Second, a main striking force to penetrate through the fighter defenses and carry out the destruction of targets in Germany and return. Two hundred bombers is considered the minimum requirement to provide self-protection and at the same time carry out worthwhile destruction. Third, the covering force to attack still another area and attract fighters in order to divert them from the main force on withdrawal. Again, 50 bombers with fighter escort is the minimum force to carry out such a function.

(c) In order to establish a yardstick to be used in the determination of the number of bombers required to destroy the objectives desired, the following procedure was employed:

Twelve successful missions were conducted in January, February and March. Approximately 100 bombers were dispatched on each. It was found that sufficient bombs fell within a circle of 1,000-foot radius centered about the aiming point to cause the desired destruction. For each prospective target the number of 1,000-foot radius circles necessary to cover it has been calculated. The yardstick, as determined by experience, is, therefore, the number of 1,000-foot radius circles of destruction, each requiring 100 bombers.

(d) The plan of operations is divided into four phases (see Chart E).¹ The depth of penetration, the number of targets available and the capacity of the bombing forces increases successively with each phase.

(e) Seventy-six precision targets have been selected for Eighth Air Force bombing operations. Having selected these 76 targets the questions arise: Can they be effectively destroyed, and, if so, how many bombers will be required? As to the first question, operational experience answers yes.

6. EFFECTIVENESS OF EIGHTH AIR FORCE

(a) The operations of the United States Army Air Force in daylight bombing of defended objectives in German-occupied Europe have been sufficient to establish a criterion of precision daylight bombing effectiveness; the operations of the R.A.F. Bomber Command leave no room for doubt of the ability of that force to devastate industrial areas.

(b) The daylight operations of the Eighth Air Force from the 3rd January, 1943, to the 6th April, 1943, definitely establish the fact that it is possible to conduct precision-pattern bombing operations against selected precision targets from altitudes of 20,000 to 30,000 feet in the face of anti-aircraft artillery and fighter defenses.

(c) Of 20 missions dispatched by the United States Eighth Air Force in that period, 12 have been highly effective. These 12 daylight missions have been directed against a variety of targets, including:

- Submarine bases
- Locomotive shops
- Power houses
- Marshalling yards
- Shipbuilding yards
- Motor vehicle and armament works
- Airplane engine factories

The average number of aircraft dispatched against these targets has been 86. The destructive effect has, in every case, been highly satisfactory. From this experience it may be definitely accepted that 100 bombers dispatched on each successful mission will provide entirely satisfactory destructive effect of that part of the target area within 1,000 feet of the aiming point; and that two-thirds of the missions dispatched each month will be successful to this extent.

7. FORCES REQUIRED

(a) Heavy bombers

(1) In computing the force required, a yardstick of 100 bombers dispatched per target area of 1,000 feet about each aiming point has been accepted as a reasonable product of actual experience to date. Each target has been evaluated in terms of these 'Target Units,' or the number of 1,000-foot radius circles in which this destructive effect must be produced.

- (2) Experience in the European Theater to date indicates that at least 800 airplanes must be in the theater to dispatch 300 bombers on operations. Hence, until the level of United States bomber strength in this theater reaches approximately 800, it will not be feasible to sustain a precision bombing offensive against the German fighter factories. It is estimated that we will be able to accommodate and train a force of this capacity by July of this year. In the interim every effort should be made to reduce the German fighter force by attack of those fighter factories which can be reached, and by combat under favourable conditions. The repair depots and airdromes are included for the purpose of giving commanders the necessary tactical latitude. Concurrently, operations can be conducted against submarine installations within reach and against other targets contributing directly to the principal objectives which are within covering range of our own fighters, or which do not require deep penetration. Some operations will have to be conducted to provide the necessary training for the incoming forces; such operations must be conducted against objectives within the listed categories.
- (3) During the next phase, from July to October, in which it is estimated that we will be able to penetrate to a limit of 400 miles, a determined effort must be made to break down the German fighter strength by every means at our disposal, concentrating primarily upon fighter aircraft factories. During this time interim an additional increment of 248 bombers are required, so that the strength in the theater by October should be approximately 1,192. This would provide a striking force of 450 bombers at the end of this period. The average striking force during this period would be 400.
- (4) During the third phase the German fighter force must be kept depleted, and the other sources of German strength must also be undermined. During this phase our bombing offensive force must be adequate to perform all their major tasks.
- (5) From October to January an additional increment of 554 bombers are required, bringing the total to 1,746. This should provide an operational striking force of 655 bombers at the end of that time. The average striking force during this period will be 550 bombers.
- (6) During the last phase--early 1944--the entire force should be used to sustain the effect already produced and to pave the way for a combined operation on the Continent. This will require a force of 2,702 heavy bombers.
- (7) It will be observed that the charts of the actual location of the targets to be attacked in each phase show the joint bombing effort of each phase. It will be noted that, in the first phase (see Map 1),¹ operations are limited to relatively shallow penetration. They include submarine bases along the coast, submarine construction yards, and the Focke-Wulf airplane factory at Bremen. Actually, of course, these operations have all been undertaken with the small forces available and in the

case of the submarine yards at Vegesack and the Focke-Wulf plant at Bremen, a long step has already been taken towards completion of the plan. There are two other systems of operations calling for deep penetrations shown in this phase. One of them calls for an attack against oil installations in the Ruhr. This operation is entirely contingent upon an earlier attack from the Mediterranean area against the oil refineries at Ploesti in Rumania. Such an attack is under consideration now, and if it is carried out we will be forced to operate against the Ruhr refineries in order to exploit the advantage achieved in Rumania. The other attack calls for a very deep penetration at Schweinfurt. This operation might be undertaken as a surprise attack in view of the tremendous advantages accrued from a successful destruction of these plants; however, it would be most unwise to attempt it until we are perfectly sure we have enough force to destroy the objective in a single operation. Any attempt to repeat such an attack will meet with very bitter opposition. In the second phase (see Map 2),¹ the plan calls for a concentration of effort against the German fighter assembly and fighter aircraft factories as well as attacks against airdromes and repair facilities. It is anticipated that approximately 75% of the striking force will be applied to this end during this phase. The other 25% is directed against submarine construction yards. In the third phase (see Map 3)¹ an all-out attack against all the principal objectives is provided as well as repeat operations to continue neutralization of installations which have been destroyed and which can be repaired. During the fourth phase (see Map 4),¹ these operations are continued and allowances made for concentration of attacks against installations more directly associated with a cross-channel operation such as rail transportation, arsenals, Military installations, &c.

- (8) The determination of the number of aircraft required in each phase has been based strictly upon past experience. As to the rate of operations, the Eighth Air Force has averaged six per month over the past six months. In the past three months, it has actually carried out twelve highly successful operations out of a total of twenty. This plan is based on a total of twelve successful operations in each three-month phase and recognizes the probability that the other six will for one reason or another be less satisfactory. Experience has shown that about 3/8ths of the total number of airplanes in the theater can be dispatched on operational missions at any one time. This makes allowances for the airplanes in depot reserve, those in depot repair, and those being ferried and modified. There is every reason to believe that our forces will be more effective in the future than these figures indicate. In order to be as realistic as possible, however, the plan has been based in each case upon actual past experience.
- (9) Chart E1 tabulates all the targets for contemplated destruction by the United States and British bomber forces to carry out the

mission. The precision targets for attacks by the United States Bomber Command are shown as small symbols. The cities and towns in or near those precision targets and which constitute the complementary targets of the R.A.F. are shown as in circles. The German fighters are at present deployed in four main concentrations positioned well forward to the coast. In general, the day fighters are in four lots of approximately 100 each in the general areas of north-west coastal Germany, Holland and Belgium, the channel coast of France and western France in the vicinity of the submarine pens. These fighters are capable of concentrating laterally from bases at least 200 miles away, so that forces of 300 fighters might be employed against our main efforts if we penetrated directly towards the Ruhr without distracting or diverting part of them.

- (10) Chart D1 is illustrative of the effect of this plan of operations upon the intermediate objective, German fighter strength. This chart must be considered as pictorial rather than precise. The top line shows the increase in German fighter strength. That is a German capability if they choose to follow it. If German production is not interrupted and if German wastage is not increased, it is possible for Germany to have in operation 3,000 fighters by next April. The broken line shows the effect of our operations upon that German fighter strength. In the first phase we do not expect to accomplish a great deal because our forces will not have been built up to decisive proportions. In the second phase, our attacks against German fighter factory (sic) and engine factories and the increased attrition should cause the levelling off of the German fighter strength. In the third phase the full effect of the attacks against German fighter production should make themselves felt so that German fighter strength should fall off rapidly in this phase. In the fourth phase that German fighter strength should decline at a precipitant rate. This second line has been computed in the following manner: The decrease in German fighter strength is the result of two factors. One is the attacks against German fighter factories, the other the accelerated rate of combat wastage caused by our increased bomber forces. This wastage rate has been computed in an extremely conservative manner. It is realized that past claims of enemy aircraft shot down may seem high, although our evaluation of them is very careful; nevertheless, in order to avoid any charge of unwarranted optimism combat claims have been arbitrarily divided by four, the resulting decrease in German fighter strength dependent upon expected combat wastage is at a rate only one quarter as great as our present claims. Even under these very conservative assumptions it is apparent that the German fighter strength will have passed its limit by the end of the second phase, and its powers of resistance should decline very rapidly thereafter.

(b) *Medium bombers*

It will be noted that no United States medium bombardment aircraft have been specifically included in the computations of force required above. That does not mean that medium bombardment is not necessary to implement this plan. Supplementary attacks against all strategic targets within range of medium bombers are anticipated as necessary adjuncts to the heavy bomber attacks. In addition, medium bombardment is required in order to conduct repeated attacks against German fighter airdromes, to aid the passage of the heavy bombers until the attacks against the German aircraft industry make themselves felt. Medium bombardment will be necessary to support combined operations in early 1944. The crews must be operationally trained in this theater by that date.

(c) *Fighters*

At all times there is a need for an extensive United States fighter force both to protect the bombers and to assist in the reduction of the German fighter strength. Prior to the initiation of operations on the Continent, this fighter strength must be at a maximum, and must be fully trained for operations in this theater.

Note. This plan deals entirely with the requirements for the strategic bombing force, except for its use in the 4th Phase on missions which will render most effective support to surface operations on the Continent, which may begin in early 1944. In order to supplement this force in providing the close support required for the surface operations, steps must be taken to create and train a tactical force in this theater. This force must include light bomber, reconnaissance, fighter, and troop carrier elements.

8. CONCLUSIONS

(a) *Recapitulation of United States bomber forces required:*

	<i>Heavy</i>	<i>Medium</i>
1st Phase . . .	944	200 Bombers required by June 30, 1943.
2nd Phase . . .	1,192	400 Bombers required by September 30, 1943.
3rd Phase . . .	1,746	600 Bombers required by December 31, 1943.
4th Phase . . .	2,702	800 Bombers required by March 31, 1944.

(b) If the forces required as set forth above are made available on the dates indicated, it will be possible to carry out the mission prescribed in the Casablanca Conference. If those forces are not made available, then that mission is not attainable by mid-1944.

(c) Depletion of the German fighter strength must be accomplished first. Failure to neutralize that force will jeopardize the prosecution of the war toward a favourable decision in this theater.

(d) The following bombing objectives should be destroyed under the provisions of the general directive issued at the Casablanca Conference:

(1) *Intermediate objectives:*

German fighter strength.

(2) *Primary objectives:*

German Submarine yards and bases.

The remainder of the German aircraft industry.

Ball bearings.²

Oil.² (Contingent upon attacks against Ploesti from the Mediterranean.)

(3) *Secondary objectives in order of priority:*

Synthetic rubber and tires.

Military motor transport vehicles.

(e) The following statement of principle, expressed by the Operations Analysts, is concurred in:

In view of the ability of adequate and properly utilised air power to impair the industrial source of the enemy's Military strength, only the most vital considerations should be permitted to delay or divert the application of an adequate air striking force to this task.

Reprinted from:

Sir Charles Webster and Noble Frankland, *The Strategic Air Offensive Against Germany 1939-1945*, (London: Her Majesty's Stationery Office, 1961) pp 273-283.

1956 WAR - AIRFIELD DATA AND AIR-ORDER-OF-BATTLE

APPENDIX E

Table E-1. Egyptian Air Force order of battle, October 1956.

<u>Base</u>	<u>Unit</u>	<u>Aircraft</u>	<u>(Strength in Parenthesis)</u>	<u>Remarks</u>
Abu Sueir	30th Fighter Sqdn.	MIG-15	(15)	
Kabrit	1st Fighter Sqdn. 20th Fighter Sqdn.	MIG-15 MIG-15	(15) (15)	
Fayid	2nd Fighter Sqdn. 5th Fighter Sqdn. 40th Fighter Sqdn.	Vampire Meteor Vampire Meteor	(15) (12) (10) (20)	
Almaza*	? Fighter Sqdn.	Meteor N.F. 13	(6)	
		Fury**	(8)	
		Vampire	(15)	
Kasfaret	31st Fighter Sqdn.	IL-28	(12)	In organizational phase
Cairo West	8th Light Bomber Sqdn.	IL-28	(12 + 5 in Reserve)	
	9th Light Bomber Sqdn.	IL-28	(20)***	
Luxor	? Fighter Sqdn.	MIG-15		Utilized by fighters****
Inchash				

* Entire EAF transport force also based at Almaza.

** Propeller-driven fighter-bomber.

*** No references to an operational unit at Luxor were found so these aircraft may have been in storage.

**** General Dayan's book indicated that Inchash was utilized by jet fighters although no specific units were identified as being based there. A post-war article in RAF Flying Review identified Inchash as a MIG-15 squadron base and the fact that it was a first priority target in the initial 31 October strike strongly suggests that the article was correct. It is probable that the 30 October photo-reconnaissance missions showed more accurate last minute unit disposition intelligence than was available to the Israelis.

Table E-2. Status of Egyptian airfields in October-November 1956.

No.	Airfield	No. of Runways	Longest Runway	Use	Remarks
1.	Abu Suweir	2	9000 feet	Military	*
2.	Alexandria (Aboukir Airfield)	4	5900 feet	Civilian	
3.	Almaza	4	6300 feet	Military	*
4.	Bilbeis	4	5100 feet	Military	* EAF College
5.	Cairo International	4	9100 feet	Civilian	*
6.	Cairo West	2	9000 feet (?)	Military	*
7.	Dekheila	4	6000 feet	Military	*
8.	Deversoir	4 (3 in use) 4 (2 in use)	5500 feet 6300 feet	Military	* Probable
9.	Fayid	1	5700 feet	Military	*
10.	Heliwan	1	5700 feet	Military	* Probable
11.	Inchas	4	6000 feet	Military	*
12.	Ismaila	4	4600 feet	Civilian	*
13.	Kabrit	4	9000 feet	Military	*
14.	Kassfareet	4 (3 in use)	6100 feet	Military	* Probable
15.	Luxor	2	6000 feet (?)	Military	*
16.	Port Said	2	4800 feet	Civilian (also called Gamil Airport)	
17.	Shallufa	4	7200 feet	Military	* Probable
In addition, three emergency airfields in the Sinai were available:					
18.	Bir Hamma	3	?	Military (being improved for MIGs)	
19.	Bir Jifjafah	1	?	Military	
20.	Al Arish	3	?		

* Indicates that airfield was attacked by allied aircraft.

Table E-3. British and French strike/strike support aircraft basing.

	<u>RAF</u>	<u>SQUADRON</u>	<u>AIRCRAFT</u>	<u>BASE</u>
•	Medium Bomber	No. 138	8 Valiant B.1	Luqa, Malta
		No. 148	8 Valiant B.1	Luqa, Malta
		No. 207	8 Valiant B.1	Luqa, Malta
		No. 214 DET*	4* Valiant B.1	Luqa, Malta
•	Light Bomber	No. 101	8 Canberra B.6	Luqa, Malta
		No. 109 DET	4 Canberra B.6	Luqa, Malta
		No. 139 DET	4 Canberra B.6	Luqa, Malta
		No. 9	8 Canberra B.6	Halfar, Malta
		No. 12	8 Canberra B.6	Halfar, Malta
		No. 10	8 Canberra B.2	Nicosia, Cyprus
		No. 15 DET	4 Canberra B.2	Nicosia, Cyprus
		No. 18 DET	4 Canberra B.2	Nicosia, Cyprus
		No. 27	8 Canberra B.2	Nicosia, Cyprus
		No. 35 DET	4 Canberra B.2	Nicosia, Cyprus
		No. 44	8 Canberra B.2	Nicosia, Cyprus
		No. 61	8 Canberra B.2	Nicosia, Cyprus
		No. 115 DET	4 Canberra B.2	Nicosia, Cyprus

*Bomber Squadron Detachments presumed to consist of at least 4 aircraft.

Table E-3. British and French strike/strike support aircraft basing (Continued).

<u>RAF</u>				
	<u>SQUADRON</u>	<u>AIRCRAFT</u>	<u>BASE</u>	
•	Fighter	No. 1 No. 34 No. 6 No. 8 No. 32 No. 249 No. 13 No. 543	16 Hunter F.5 16 Hunter F.5 16 Venom F.B.4 16 Venom F.B.4 16 Venom F.B.4 16 Venom F.B.4 8 Canberra P.R.7 2-4 Valiant B.(P.R.)1	Nicosia, Cyprus Nicosia, Cyprus Akrotiri, Cyprus Akrotiri, Cyprus Akrotiri, Cyprus Akrotiri, Cyprus Akrotiri, Cyprus Akrotiri, Cyprus
•	Fighter Bomber			
•	Tactical Reconnaissance			
<u>FAF</u>				
	<u>WING</u>	<u>AIRCRAFT</u>	<u>BASE</u>	
•	Fighter	2 Escadre	36 Mystere IV A (2 Sqns)	Haifa (probably Ramat David), Israel
•	Fighter Bomber	1 Escadre	18 F-84F (1 Sqn)	Lydda, Israel
		3 Escadre	18 F-84F (1 Sqn)	Akrotiri, Cyprus
•	Tactical Reconnaissance	33 Escadre	18 RF-84F (1 Sqn)	Akrotiri, Cyprus

Table E-3. British and French strike/strike support aircraft basing (Concluded).

	<u>RN</u>	<u>SQUADRON</u>	<u>AIRCRAFT</u>	<u>CARRIER</u>
●	Fighter	No. 809	8 Sea Venom FAW.22	HMS Albion
		No. 894	8 Sea Venom FAW.21	HMS Albion
		No. 895	8 Sea Venom FAW.21	HMS Albion
		No. 891	8 Sea Venom FAW.21	HMS Eagle
		No. 893	8 Sea Venom FAW.21	HMS Eagle
		No. 800	8 Sea Hawk F.G.A.4	HMS Albion
		No. 802	8 Sea Hawk F.G.A.3	HMS Albion
		No. 810	8 Sea Hawk F.G.A.6	HMS Albion
		No. 804	8 Sea Hawk F.G.A.4	HMS Bulwark
		No. 897	8 Sea Hawk F.G.A.4	HMS Bulwark
		No. 899	8 Sea Hawk F.G.A.4	HMS Eagle
		No. 830	8 Wyvern F.4	HMS Eagle
		No. 831	8 Wyvern F.4	HMS Eagle
	<u>FN</u>	<u>SQUADRON</u>	<u>AIRCRAFT</u>	<u>CARRIER</u>
●	Fighter	14F	12 F4U Corsair	Arromanches
		15F	12 F4U Corsair	Arromanches
		9F	12 TBM Avenger	Lafayette
●	Strike			

Table E-4. Aircraft strength by base/carrier.

BASE	Valiant	Canberra	Hunter	Venom	RAF/FAF			Canberra PR	RF-84F	Total
					Mystere IV A	E-84F	RH/FN			
HalFar, Malta	-	16	-	-	-	-	-	-	-	16
Luga, Malta	28	16	-	-	-	-	-	-	-	44
Akrotiri, Cyprus	-	-	64	-	18	8	18	108	-	108
Nicosia, Cyprus	-	48	32	-	-	-	-	-	-	80
Haifa, Israel	-	-	-	36	-	-	-	-	-	36
Lydda, Israel	-	-	-	-	18	-	-	-	-	18
	28	80	32	64	36	8	18	18	18	302
RN/FN										
Carrier	Sea Venom	Sea Hawk	Hyvern	Corsair	Avenger					Total
HMS Albion	24	24	-	-	-	-	-	-	-	48
HMS Bulwark	-	16	-	-	-	-	-	-	-	16
HMS Eagle	16	8	16	-	-	-	-	-	-	40
Arromanches	-	-	-	24	-	-	-	-	-	24
Lafayette	-	-	-	12	-	-	-	-	-	12
	40	48	16	24	12	12	12	12	12	140

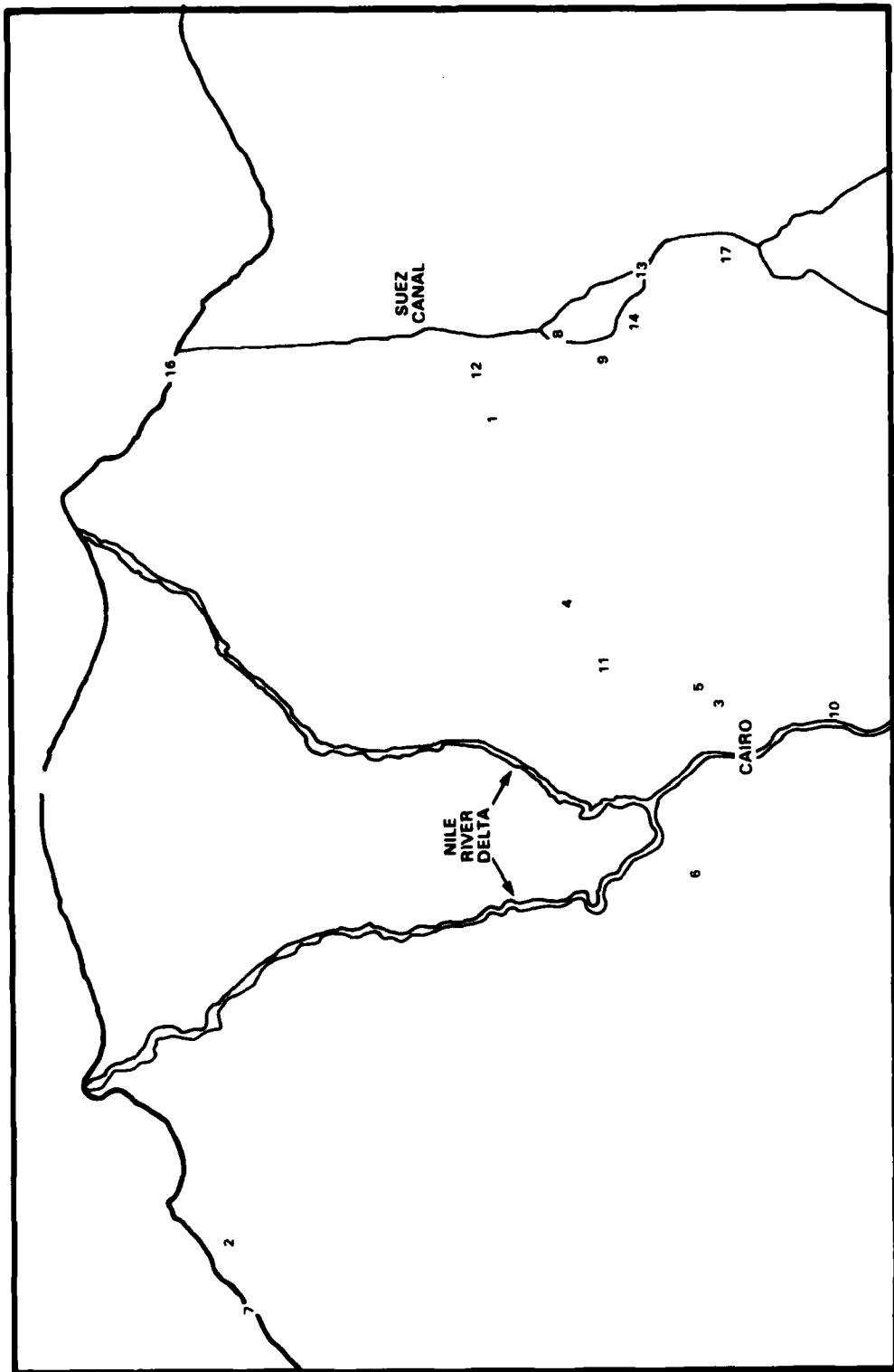


Figure E-1. Egyptian airfields in the Nile Delta/Canal Zone, October 1956.

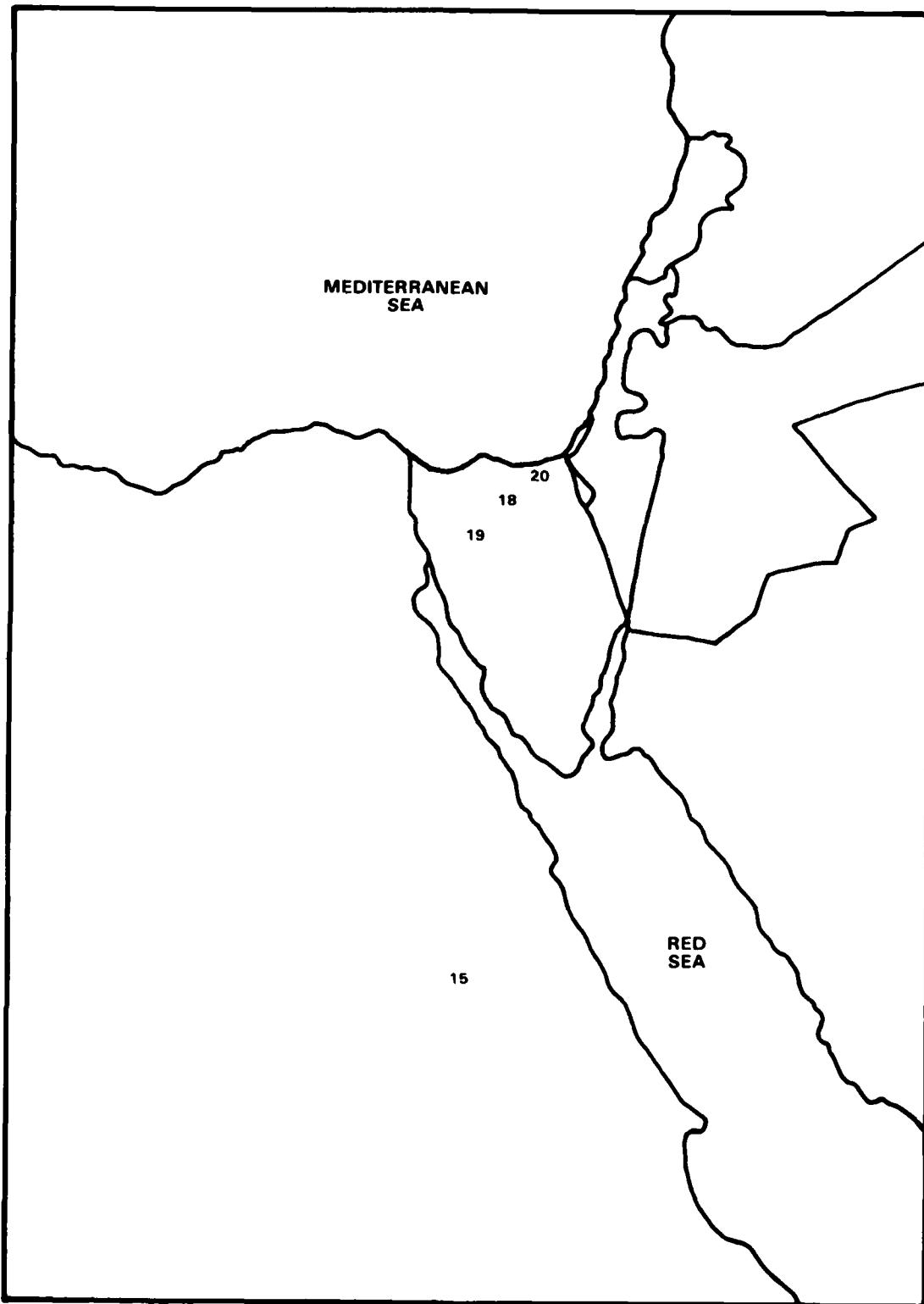


Figure E-2. Egyptian airfields in the Sinai and South Egypt, October 1956.

APPENDIX F

1967 WAR - AIRFIELD AND AIR-ORDER-OF-BATTLE DATA

Table F-1. Status of Egyptian jet-capable airfields.

<u>No.</u>	<u>Airfield</u>	<u>No. Runways</u>	<u>Use</u>	<u>Remarks</u>
1	Abu Suweir	2	Military	*
2	Al Arish	3	Military	*
3	Al Minya	1	Military	*
4	Aswan Dam	1	Military/ Civilian?	
5	Beni Suef	1	Military	*
6	Bilbeis	4	Military	*
7	Bir Gifgafa	1	Military	*
8	Bir Thamada	1	Military	*
9	Cairo International	2	Civilian	*
10	Cairo West	2	Military	*
11	Daraw	1	Military?	
12	El Mansura	1	Military	*
13	Fayid	4	Military	*
14	Gebel Libni	1	Military	*
15	Helwan	1	Military	*
16	Hurghada	1	Military	*
17	Inchas	3	Military	*
18	Kabrit	4	Military	*
19	Kafr Daud	1	Military	
20	Luxor	2	Military	*
21	Matruh	2	Military?	
22	Quweisna	1	Military	
23	Ras Banas	1	Military	*

Non-jet-capable airfields struck by the Israeli Air Force are listed below:

24	Dekheila	3	Military	*
25	Deversoir	4	Military	*
26	Ras Sudr	1	Military	*

*Indicates that airfield was attacked by the Israeli Air Force in 1967.

Table F-2. Reported Egyptian air force basing, June 1967.

Airfield	MIG-17	MIG-19	MIG-21	SU-7	TU-16	IL-28	AN-12	IL-14	MIG-6	MIG-4	Remarks
Abu Suweir	-	-	X	-	X	-	-	-	-	-	-
Cairo West	X	-	X	X	X	-	-	-	-	-	-
Beni Suef	-	-	-	X	-	-	X	-	-	-	-
Fayid	-	X	X	-	-	-	-	-	-	-	-
Inchas	-	-	X	-	-	-	-	-	-	-	-
Bir Gifgafa	X	-	X	-	-	-	-	-	X	-	-
Hurghada	-	-	X	X	-	-	-	-	-	-	-
Al Arish	X	-	-	-	-	-	X	-	-	-	-
Gebel Libni	X?	-	-	-	-	-	-	-	-	-	-
Bir Thamada	X	-	-	-	-	-	-	-	-	-	-
Kabrit	X	-	-	-	-	-	-	-	-	-	-
El Mansura	-	-	-	-	-	-	-	-	-	-	-
Helwan	-	-	-	-	-	-	-	-	-	-	-
Al Minya	-	-	-	-	-	X*	-	-	-	-	-
Luxor	-	-	-	-	-	-	-	-	-	-	-
Ras Banas	-	-	-	-	-	-	-	-	-	-	-
Bilbeis	-	-	-	-	-	-	-	-	-	-	-
Cairo International**	X	-	X	-	-	-	X	-	-	-	MIG's based here
Almaza	-	-	-	-	-	-	-	X	X	X	X
Dekheila	-	-	-	-	-	-	-	X	-	X	-

* 8 TU-16's flew to Luxor to escape attacks at primary TU-16 bases.

** Surviving aircraft transferred here.

Table F-3. Status of Syrian jet-capable airfields June 1967.

<u>No.</u>	<u>Airfield</u>	<u>No. of Runways</u>	<u>Use</u>	<u>Remarks</u>
1	Aleppo	1	Military	
2	Bir Qutnah	1?	Military?	
3	Damascus/Mezze	1	Military/ Civilian	*
4	Deir Ez Zor South	1	Military	
5	Dumayr	1	Military	*
6	Hamah	2	Military	
7	Marj Ruhayyil	1	Military	*
8	Rasin El Aboud	2	Military	
9	Sayqal	1	Military	*
10	Tiyas (T-4)	1	Military	*

* Indicates airfields attacked by the Israeli Air Force in 1967.

Table F-4. Reported Syrian air force basing, June 1967.

<u>Airfield</u>	AIRCRAFT					
	<u>MIG-17</u>	<u>MIG-19</u>	<u>MIG-21</u>	<u>IL-28</u>	<u>IL-14</u>	<u>MI-7</u>
Damascus	X	-	-	X	X	X
Dumayr	-	-	X	-	-	-
Hamah	X	-	-	-	-	-
Marj Ruhayyil	-	-	X	-	-	-
Sayqal	-	-	X	-	-	-
Tiyas (T-4)	-	-	X	-	X	-

Table F-5. Status of Israeli jet-capable airfields, June 1967.

<u>No.</u>	<u>Airfield</u>	<u>No. of Runways</u>	<u>Use</u>	<u>Remarks</u>
1	Eqrion	4	Military	*
2	Hatserim	1	Military	*
3	Hatzor	2	Military	*
4	Lod (Lydda)	3	Military/ Civilian	
5	Megiddo	2	Decoy for Ramat David	
6	Ramat David	2	Military	*

* Primary IAF jet combat aircraft base.

Table F-6. IAF time-on-target for 5 June airfield attacks.

<u>AIRFIELD</u>	<u>COUNTRY</u>	<u>INITIAL TOT (ISRAELI TIME)</u>
Abu Suweir	Egypt	0745
Al Arish	Egypt	0745
Bir Gifgafa	Egypt	0745
Bir Thamada	Egypt	0745
Cairo West	Egypt	0745
Fayid	Egypt	0745
Gebel Libni	Egypt	0745
Inchas	Egypt	0745
Kabrit	Egypt	0745
Beni Suef	Egypt	0845
El Mansura	Egypt	1000
Helwan	Egypt	1000
Al Minya	Egypt	1015
Bilbeis	Egypt	1200
Hurghada	Egypt	1215
Luxor	Egypt	1230
Amman	Jordan	1245
Damascus	Syria	1300
Mafraq	Jordan	1300
Marj Ruhayyil	Syria	1315
Dumayr	Syria	1315
Sayqal	Syria	1315
H-3	Iraq	1500
Tiyas (T-4)	Syria	1545
Cairo International	Egypt	1715
Ras Banas	Egypt	1800

Table F-7. Total Arab aircraft losses.

	<u>TU-16</u>	<u>IL-28</u>	<u>MIG-21</u>	<u>MIG-19</u>	<u>MIG-15/17</u>	<u>SU-7</u>	<u>Hunter</u>	<u>AN-12</u>	<u>IL-14/DC-3</u>	<u>MI-6</u>	<u>MI-8/Other</u>	<u>Unidentified</u>	<u>Transports</u>	<u>TOTAL</u>
Egypt	30	29	100	29	89	14	-	8	24	10	1	4	338	
Syria	-	2	33	-	23	-	-	-	-	3	-	-	61	
Jordan	-	-	-	-	-	-	21	-	6	-	2	-	29	
Iraq	1	-	15	-	-	-	-	5	-	2	-	-	23	
Lebanon	-	-	-	-	-	-	-	1	-	-	-	-	1	
	31	31	148	29	112	14	27	8	32	10	6	4	452	

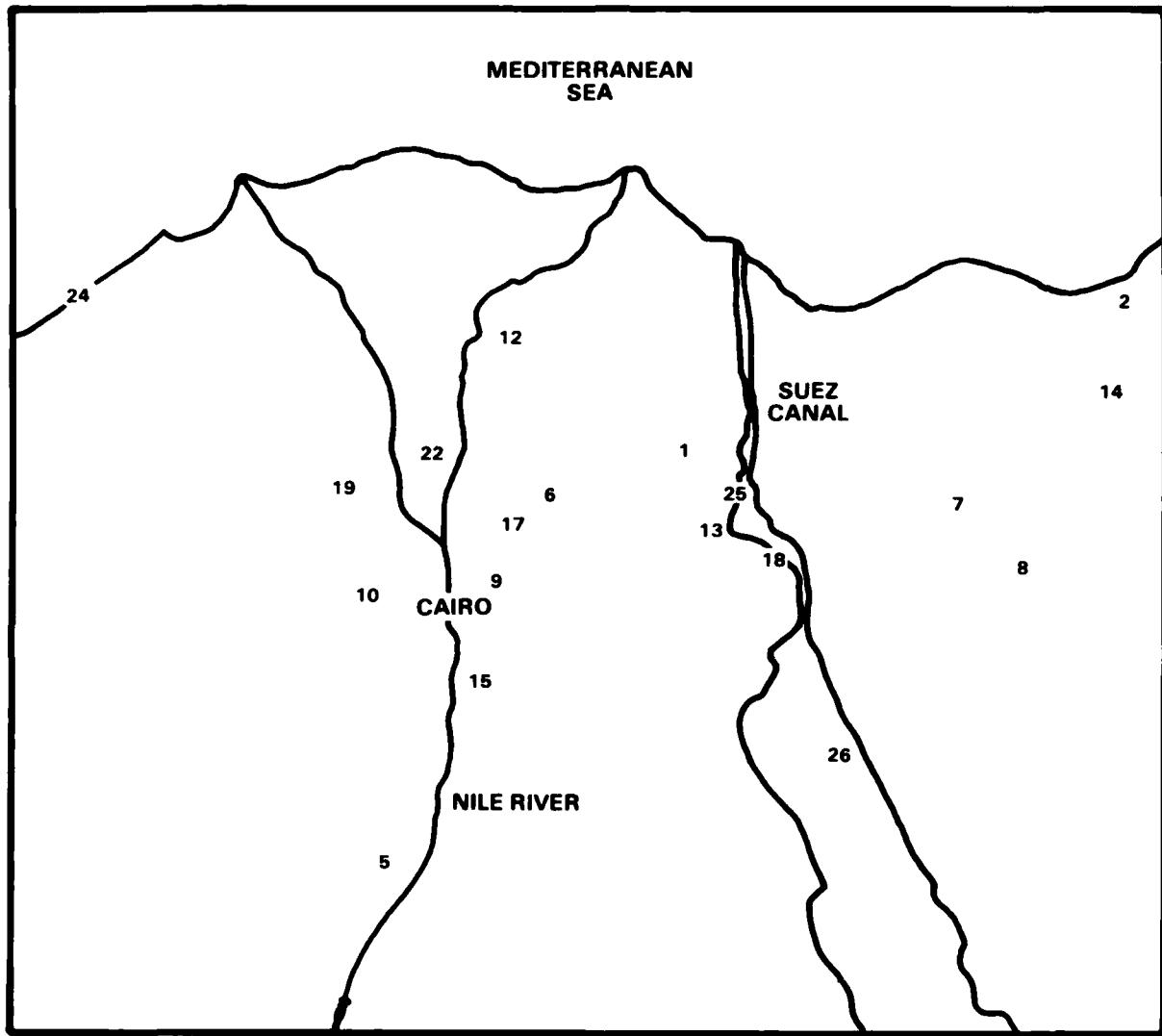


Figure F-1. Northern Egyptian jet-capable airfields, June 1967.

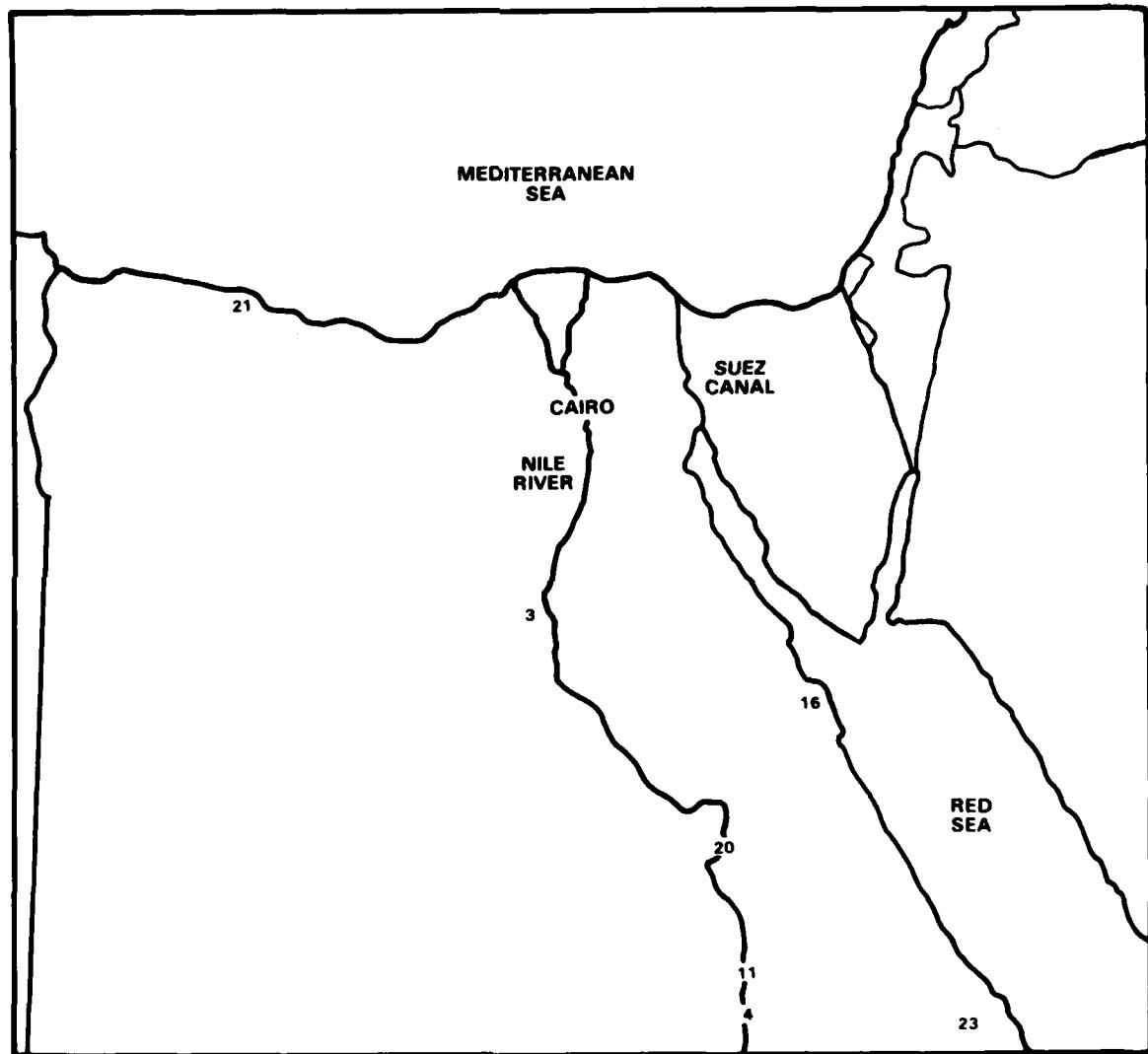


Figure F-2. Southern/Western Egyptian jet-capable airfields, June 1967.

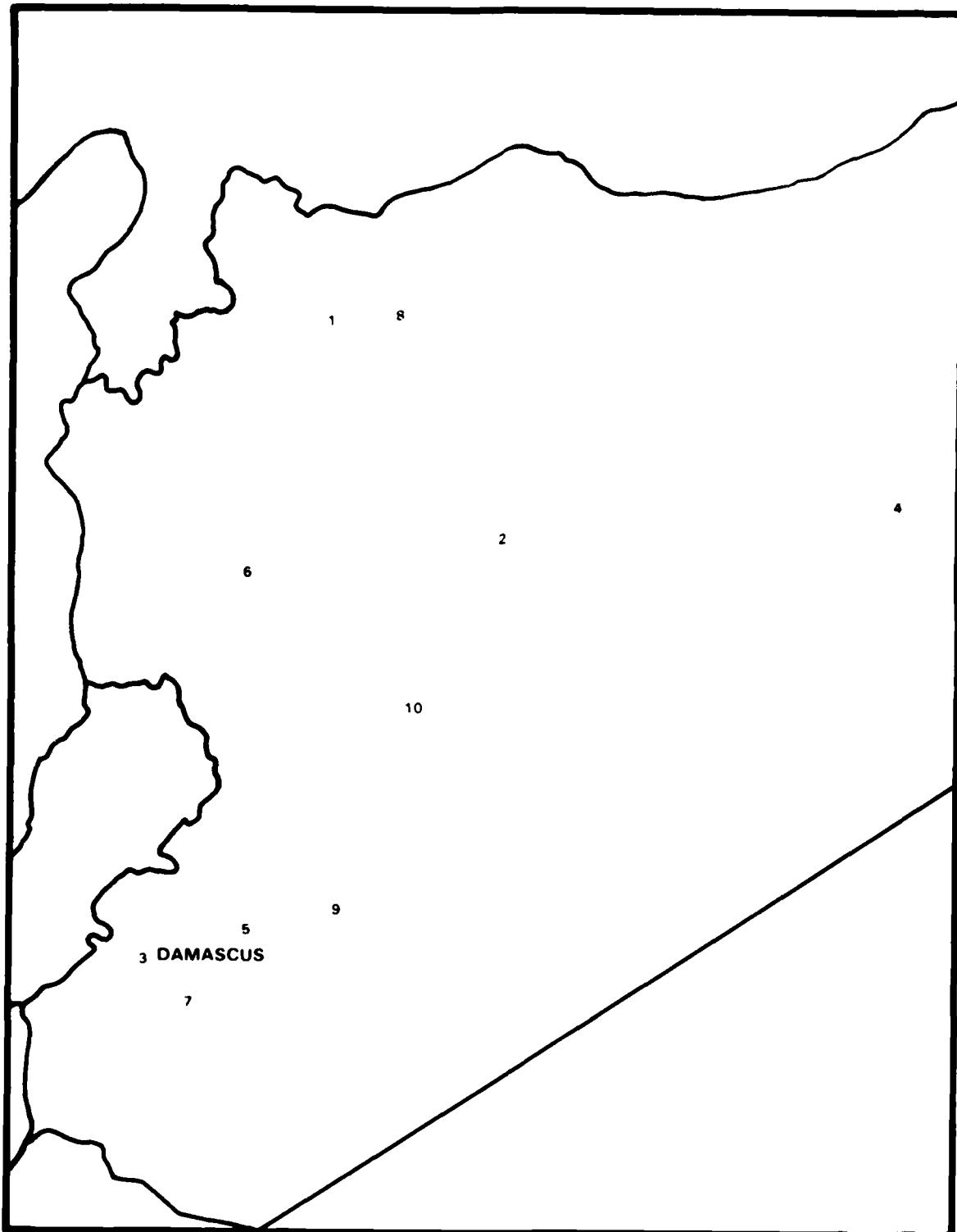


Figure F-3. Syrian jet-capable airfields, June 1967.

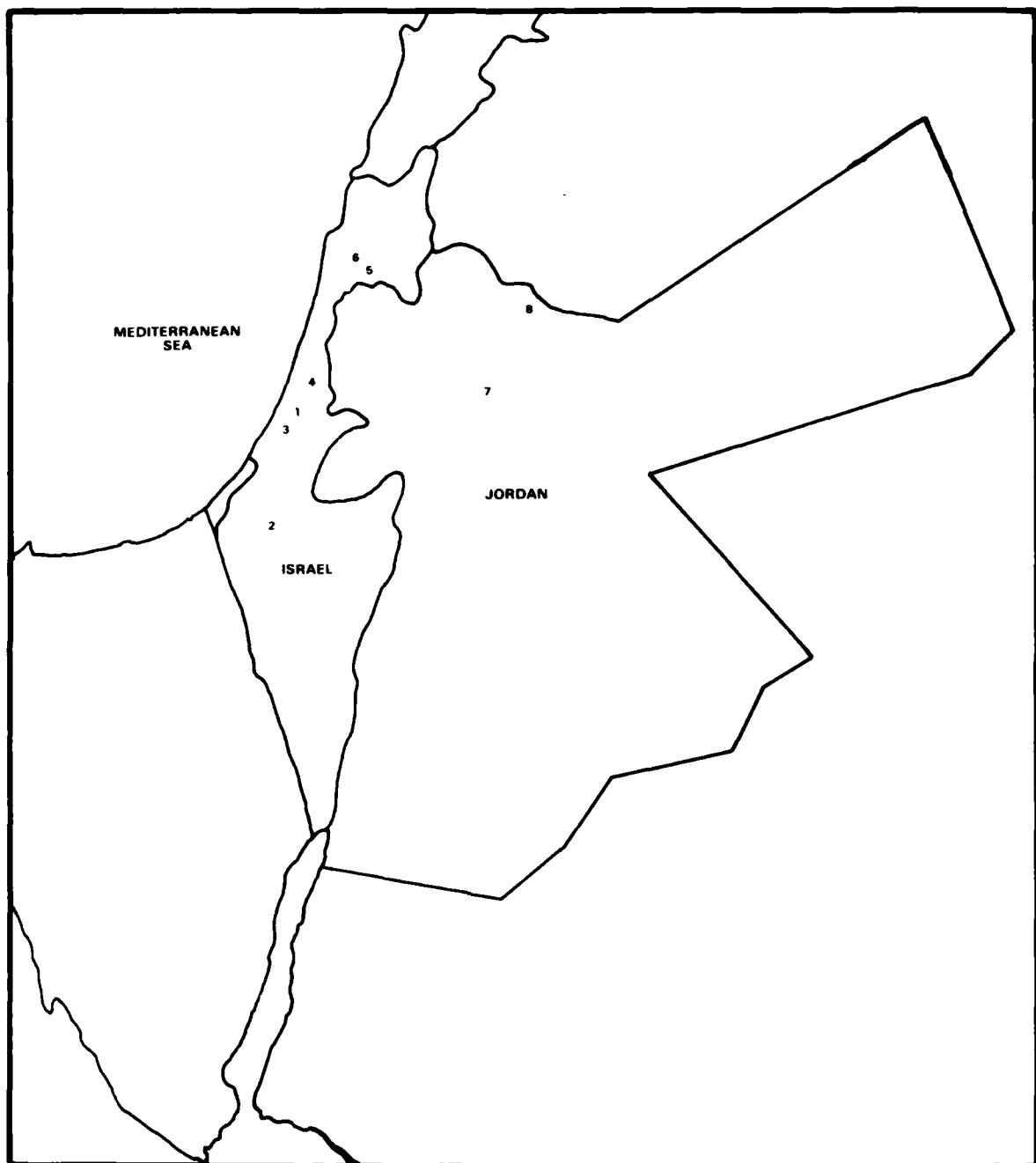


Figure F-4. Israeli and Jordanian jet-capable airfields, June 1967.

APPENDIX G
1973 WAR - AIRFIELD DATA

Table G-1. Status of Egyptian jet-capable airfields
in October 1973.

<u>No.</u>	<u>Airfield</u>	<u>No. Runways</u>	<u>Use</u>	<u>Remarks**</u>
1	Abu Suweir	2	Military	
2	Al Fayyum	1	Military	New
3	Al Minya	1	Military	
4	Al Rahmaniya	1	Military	New
5	Aswan Dam	1	Military-	Civilian?
6	Az Zaqqaziz	1	Military	New **
7	Bahiq	1	Military	New
8	Beni Suef	2	Military	New runway **
9	Bilbeis	5	Military	New runways
10	Bilbeis 2	1	Military	New
11	Bilbeis Northeast	2	Military	New
12	Birma	1	Military	New **
13	Cairo International	2	Civilian	**
14	Cairo West	3	Military	New runway**
15	Daraw	1	Military	
16	El Kharga	1	Military	New
17	El Mansura	2	Military	New runway **
18	Fayid	4	Military	
19	Helwan	1	Military	
20	Hurghada	2	Military	New runway
21	Inchas	4	Military	New runways
22	Jiyanklis New	2	Military	New
23	Kabrit	4	Military	
24	Kafr Daud	1	Military	
25	Luxor	2	Military/ Civilian?	

Table G-1. Status of Egyptian jet-capable airfields in October 1973 (Concluded).

26	Matruh	2	Military?
27	Quweisna	1	Military
28	Ras Banas	1	Military
29	Tukh Highway Strip	1	Military
30	Wadi Abu Rish	2	Military
31	Wadi Al Jandali	1	Military
32	Zalahia (Al Salihiyah)	3	Military
33	Al Manzilah	2	Military

* Although a new phonetic spelling system came into use on USAF charts between 1967 and 1973, airfields in existence in 1967 will retain their old spelling to maintain continuity with the descriptions of the 1956 and 1967 conflicts.

**Indicates that airfield was attacked by the Israeli Air Force in 1973.

Table G-2. Status of Syrian jet-capable airfields in October 1973.

<u>No.</u>	<u>Airfield</u>	<u>No. Runways</u>	<u>Use</u>	<u>Remarks</u>
1	Aleppo (Neirab)	1	Military	*
2	Al Qusayr	2	Military	New runways
3	An Nasiriyah	1	Military	New *
4	Bir Qotne	1	Military	New
5	Damascus/Mezze	1	Military	*
6	Damascus International	2	Military/Civilian	New *
7	Deir Ez Zor South	2	Military	New runway
8	Dumayr	1	Military	*
9	Hamah	2	Military	
10	Jirah	1	Military	New
11	Kholkhole	1	Military	New *
12	Marj Ruhayyil	2	Military	New runway *
13	Palmyra	1	Military	Longer runway
14	Rasin El Aboud	2	Military	
15	Sayqal	2	Military	New runway *
16	Tiyas (T-4)	1	Military	*

* Indicates that airfield was attacked by the Israeli Air Force in 1973.

Table G-3. Status of Israeli jet-capable airfields in October 1973.

<u>No.</u>	<u>Airfield</u>	<u>No. Runways</u>	<u>Use</u>	<u>Remarks</u>
1	Al Arish	3	Military	Captured *
2	Bir Hamma	3	Military	New
3	Bir Hasanah New	1	Military	Captured *
4	Bir Gifgafa	1	Military	Captured *
5	Eqron	4	Military	
6	Gebel Libni	1	Military	Captured
7	Hatserim	1	Military	
8	Hatzor	2	Military	
9	Lod	3	Military/ Civilian	
10	Ramat David	2	Military	
11	Ras Nasrani	1	Military	New *

* Indicates that airfield was attacked by the Egyptian Air Force in 1973.

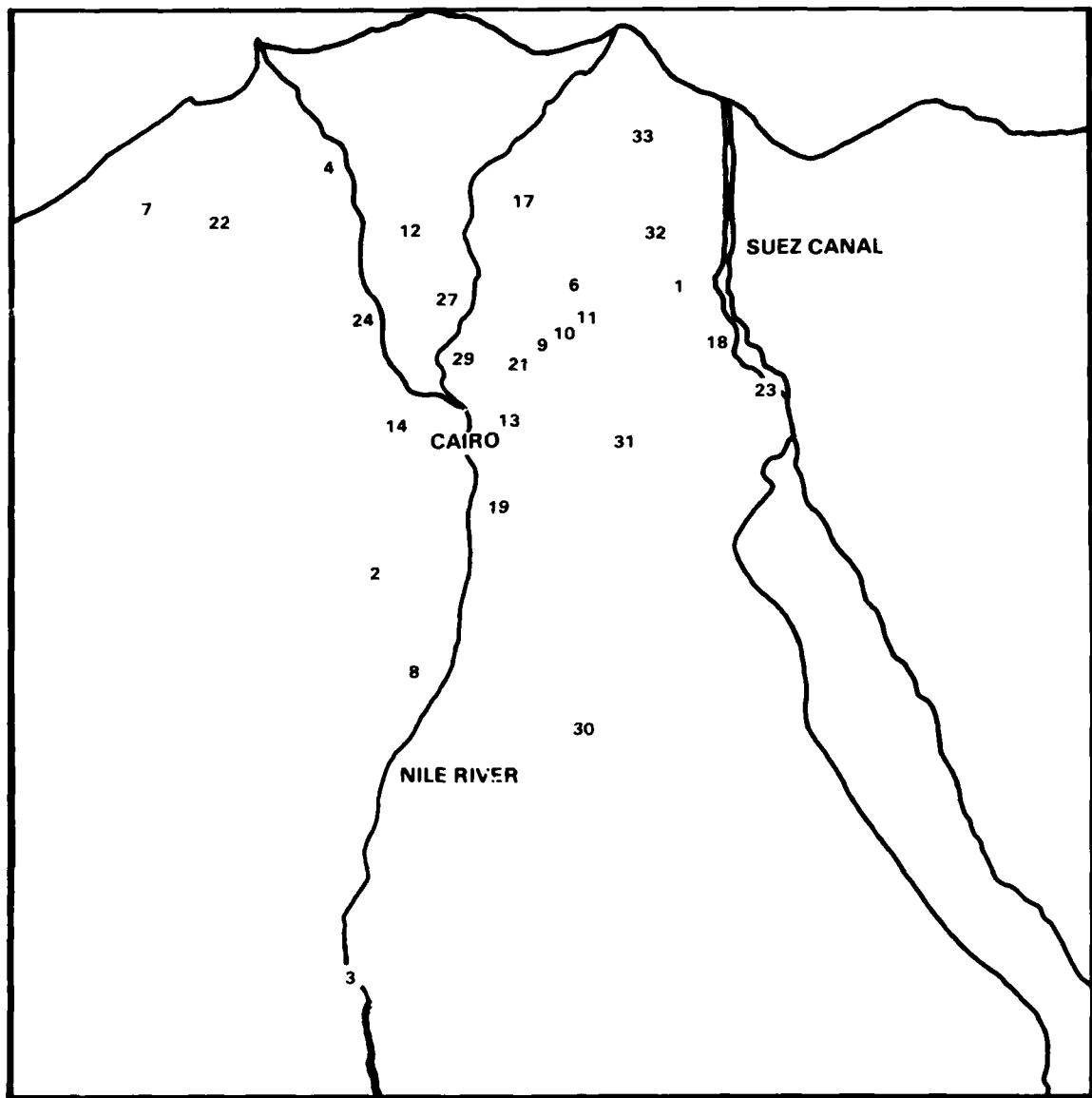


Figure G-1. Northern Egyptian jet-capable airfields, October 1973.

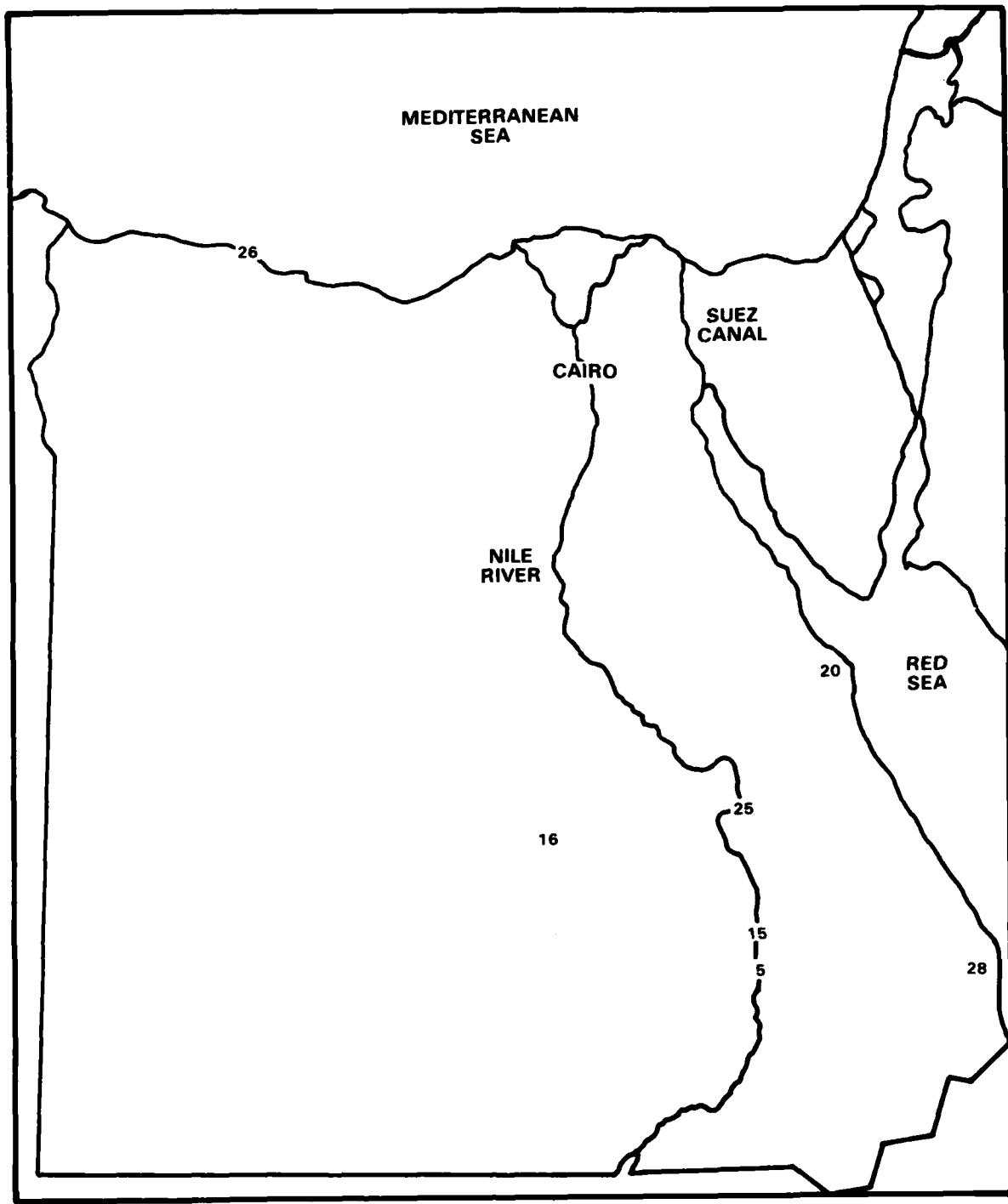


Figure G-2. Southern and Western Egyptian jet-capable airfields, October 1973.

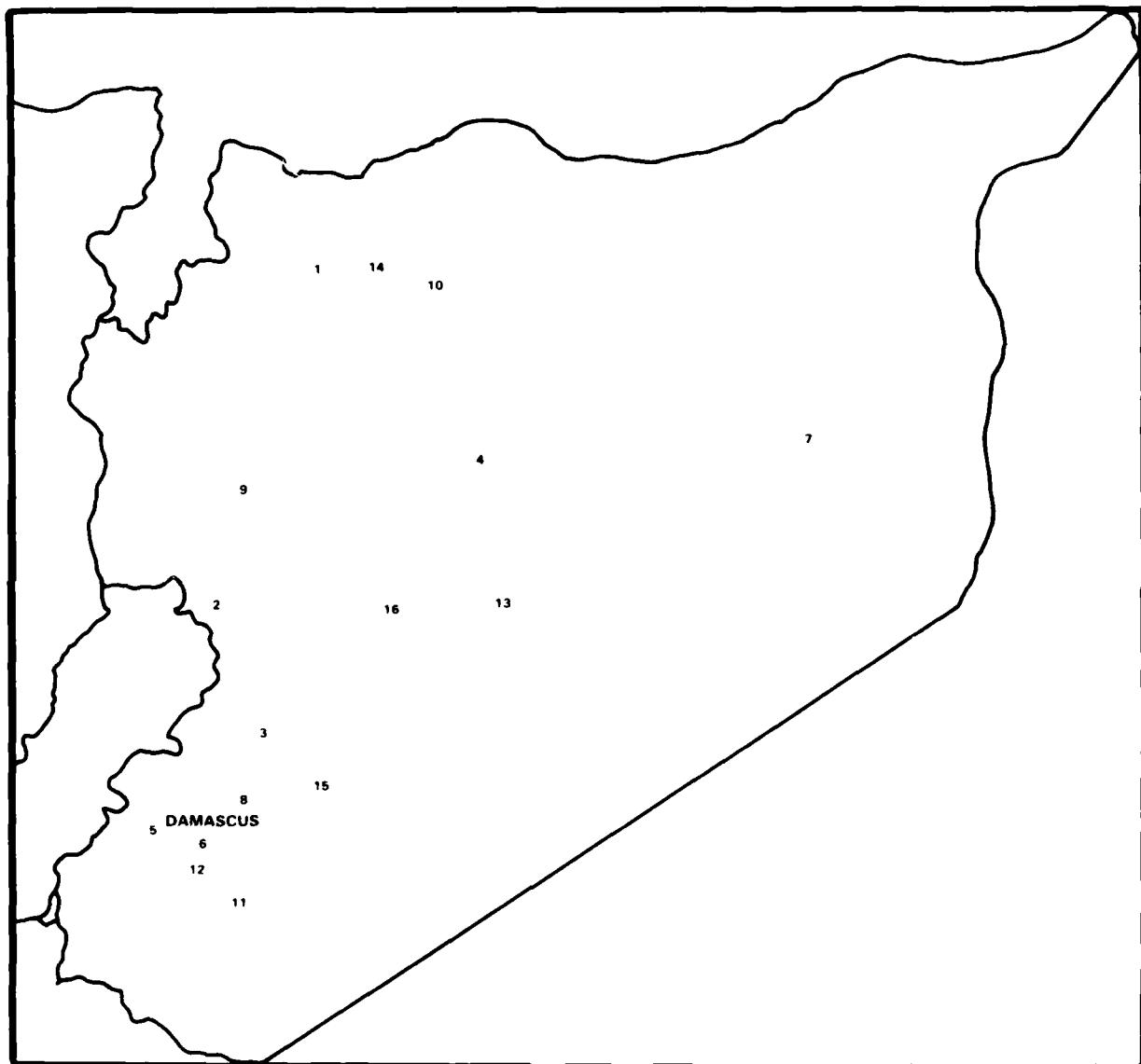


Figure G-3. Syrian jet-capable airfields, October 1973.

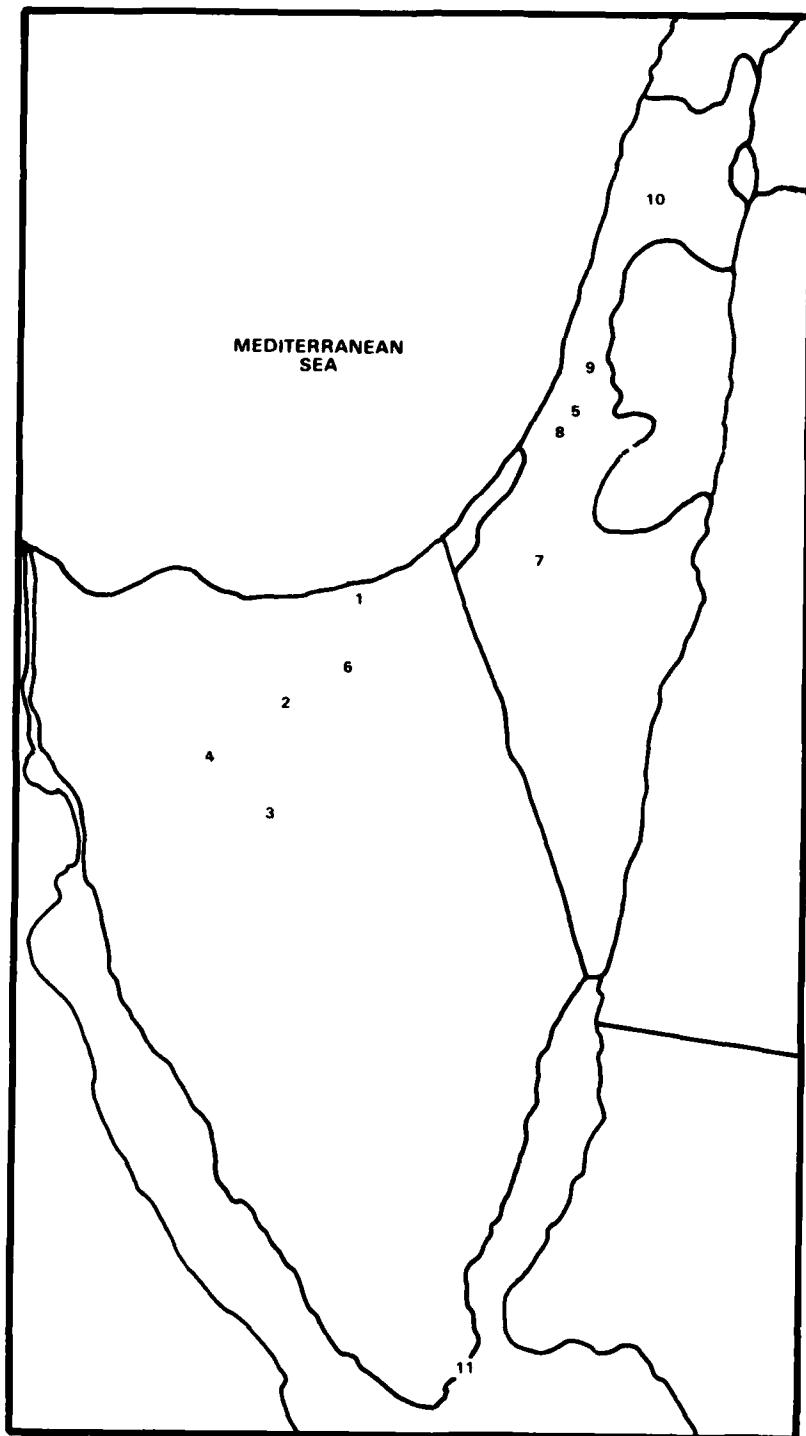


Figure G-4. Israeli jet-capable airfields, October 1973.

APPENDIX H
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- C. Magazine Articles
- D. Government Documents
- E. Newspapers

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JN-22	16 Aug 61
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ONC H-5	19 Apr 68
ONC H-5	4 Jun 69
ONC H-5	22 May 25
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WAC 447	Aug 58
WAC 448	Aug 58
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ATTN: N54

US Navy Second Fleet
ATTN: Commander

US Navy Seventh Fleet
ATTN: Commander

US Navy Third Fleet
ATTN: Commander

US Pacific Fleet
ATTN: Code N2

ATTN: Code N5

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Aerospace Defense Command
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ATTN: DOX, Mr Dillon

ATTN: XPN, J. Darrah

ATTN: XPY, J. Brown

Air Force
ATTN: INE, Estimates

ATTN: INY, INET Plns & Sys

Air Force Armament Laboratory
ATTN: AFATL/DLY

Air Force Communications Command
ATTN: XP

Air Force Operational Test & Eval Ctr
ATTN: Tech Library

Air Force Systems Command
ATTN: XR

Air Force Weapons Lab
ATTN: Tech Library

Air University Library
ATTN: AUL-LSE

Assist Ch of Staff, Studies & Analysis
ATTN: AF/SAZ, Ch Analyst

2 cys ATTN: AF/SAMI, Tech Info Div

Ballistic Missile Office/DAA
ATTN: Tech Library

Dep Ch of Staff, Rsch, Dev & Acq
ATTN: AFRD-M, Spec Assist for MX

ATTN: AFRDQ, Ophl Rqmts Dir

ATTN: AFRDS, Space Sys & C3 Dir

DEPARTMENT OF THE AIR FORCE (Continued)

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Dep Ch of Staff, Plans and Operations
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ATTN: AFXOOT, Opns, Opns, & Tng

Foreign Technology Division
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ATTN: NIIS Library
ATTN: SDN
ATTN: TQTM

Pacific Air Forces
ATTN: DCS Opns & Plans

Space Division
ATTN: YKM

Strategic Air Command
ATTN: ADWN
ATTN: NRI/STINFO
ATTN: XOXO
ATTN: XPFC
ATTN: XPFS
ATTN: XPS

Tactical Air Command
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ATTN: TAC/DEP
ATTN: TAC/DR
ATTN: TAC/INW
ATTN: TAC/INO
ATTN: TAC/SMO-G
ATTN: TAC/XPJ
ATTN: TAC/XPS

US Air Forces in Europe
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ATTN: USAFE/ADI, Intell Data Sys
ATTN: USAFE/ADN, Allied Data Sys
ATTN: USAFE/DOA, Ops Anal
ATTN: USAFE/DOC, C2
ATTN: USAFE/DOJ, Cbt Opns
ATTN: USAFE/DOO, TAC FTR Opns
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Office of Military Application, GTN
ATTN: OMA, DP-22

University of California
Lawrence Livermore National Lab
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ATTN: Tech Info Dept Library

Los Alamos National Laboratory
ATTN: MS P364 Reports Library

Oak Ridge National Laboratory
ATTN: C. Chester, Energy Div

Sandia National Laboratories
ATTN: Library & Sec Classification Div

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ATTN: Sys Studies Div 1313
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US Arms Control & Disarmament Agcy
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ATTN: W. Seymour
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ATTN: R. Burnett
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TRW Electronics & Defense Sector

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5 - 86